THE OIL WEEKLY

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PUBLISHED BY
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HOUSTON, TEXAS

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Member Audit Bureau of Circulation
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PITTSBURGH....Standard Life Bldg.
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SPECIALIZED OIL JOURNALS
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The Oil Man's Calendar

APR.	
8-10	**Petroleum Industry Electrical Association, Shreveport, Louisiana.**
13	**American Petroleum Institute, Division of Production, Pacific Coast District, Los Angeles.**
15-16	**National Petroleum Association, Cleveland, Ohio.**
26-28	**Western Petroleum Refiners Association, Hot Springs, Arkansas.**
MAY	
6-7	**American Petroleum Institute, Division of Production, Eastern District, Columbus, Ohio.**
10-16	**American Gas Association, Natural Gas Department, Kansas City, Missouri.**
19-21	**Natural Gasoline Association of America, Tulsa.**
23-27	**National Association of Purchasing Agents, (Oil Company Buyers Group), Pittsburgh, Pa.**
JUNE	
1-3	**American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colorado.**
10-12	**Pennsylvania Grade Crude Oil Association, Sailing from Buffalo, New York.**
11	**Interstate Oil Compact Commission, Santa Fe, New Mexico.**
14-19	**Second World Congress of Petroleum, Paris, France.**
25-27	**National Oil Scouts Association, Dallas, Texas.**
OCT.	
11-16	**Oil World Exposition, Houston, Texas.**
29-30	**Mid-Continent Oil and Gas Association, Texas Division, Dallas, Texas.**
NOV.	
9-12	**American Petroleum Institute, (Annual) Chicago.**

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Published every Monday. Single Copies 15 cents (Special Issues 50c). Subscription price: domestic and foreign, $2.00 a year; 2 years $3.00. Entered as second-class mail matter December 23, 1916, at the post office at Houston, Texas, under act of March 3, 1879. Subscription restricted to those engaged in the producing and pipe line branches of the oil industry or the manufacturing and distribution of oil field supplies. Advertising rates on application.

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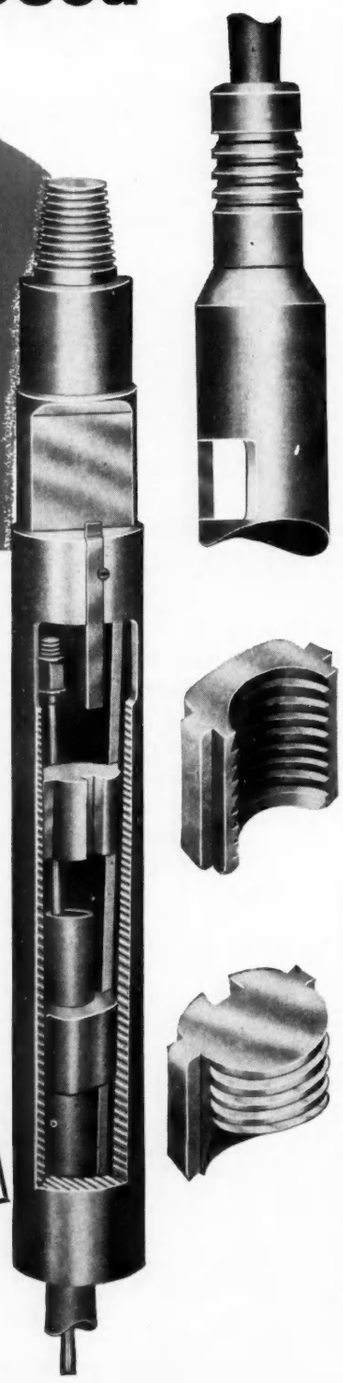

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LOOKING AHEAD

WITH THE EDITOR

Fishing With Acid
Salt Water Accumulates Oil?
Anahuac Operations Scientific

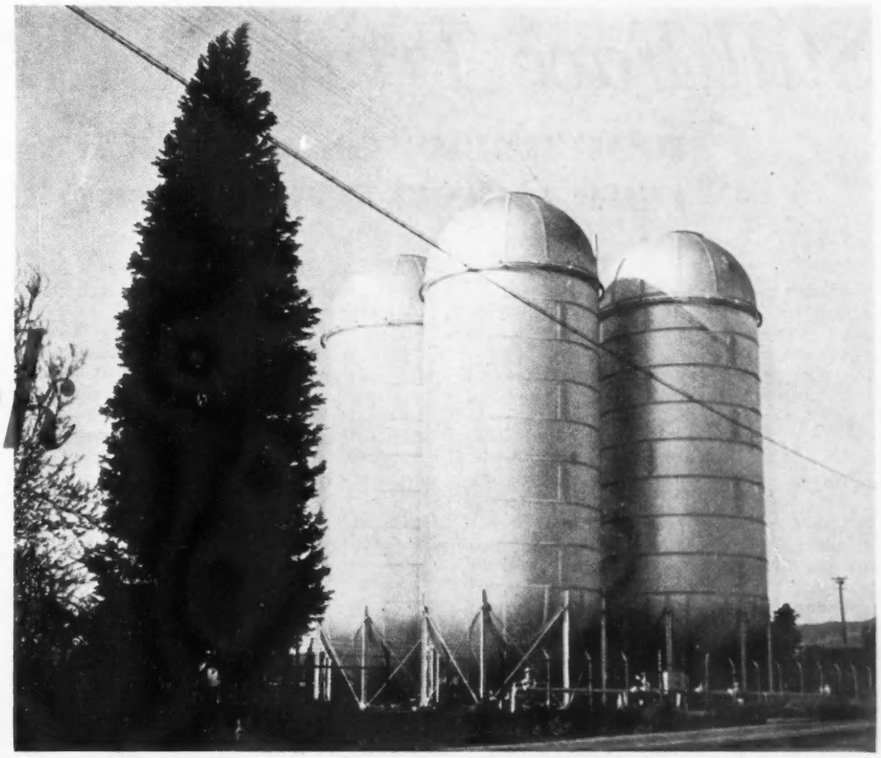
OIL accumulations are the result of salt water advancing and receding as uplifts and depressions were created back in the ages. This action would set up a water drive and push the oil ahead of it into existing traps. This is a brand new idea suggested by Jim Gardner, president, Gardner Petroleum Company, who interestingly presents his ideas. Gardner also discounts the present "anticlinal accumulation theory" on the ground that we know salt water in a well hole prevents oil and gas from coming to the surface, and therefore this idea would be impossible. No doubt some geologists will tear Gardner's theory to pieces, but others may take it and delve further into the possibilities it offers.

IT has long been known that certain acids were capable of dissolving both the metal in drill pipe and specific types of formations, and since the advent of acidizing these chemicals have been available in large quantities. Now another use has been found for them—loosening of stuck drill pipe.

It has been only recently that this new development has passed beyond the experimental stage. Treatments are proving successful in more than 50 percent of the cases, and practically 100 percent where the formation is predominantly lime and the equipment has not been previously damaged. Injections are made to eat up the formation and not the drill stem. The successful application of acid for loosening stuck drill pipe is the subject of an illustrated article next week.

MODERN scientific operating methods are being used in the Anahuac field. The advancements of practices in the field have permitted a reduction in number of casing strings, faster drilling and a saving expenditure. High gas/oil ratios have been overcome and the gas is being used most efficiently. Our series of articles on Anahuac takes up these phases next week.

This Week



A LATE style in natural gas storage is a big step forward in the matter of looks, as this view from Whittier, California, will attest if you recall the conventional holder. Each of the four bottles pictured holds two million cubic feet of gas under sixty pounds pressure. Pressure is maintained by a system of regulators. With everything under positive pressure, no water seals, etc., risk of explosion is reduced to absolute minimum.

METALLURGY to Col. Drake meant any old iron that was handy and a blacksmith who could guess when to hit it. But that is far back and considerably up the hole. While oil men have been making greater demands on tools and materials, the steel men have been keeping pace by making better tools. Thus the motif of this issue.

WHEN you were a boy you probably tore up an alarm clock or two just to see what made the things run. Harry Pennington tears up oil tools and various pieces of equipment to see what makes them run, or fail to run, from a metallurgical point of view. And he tells what he observes about the characteristics of this and that alloy in a manner that makes you realize why some of your purchases have been good ones and others—well—look at—
Page 19.

TWENTY years ago if you had suggested to the average superintendent use of heavy equipment embodying considerable nickel in its composition, he probably would have directed at you that same twinkle of tolerant kindness and tenderness seen in the eyes of a pitying magistrate examining a likely candidate for the state's lunacy wards. Today the reception would be different, for the value of nickel in steels subjected to the toughest of tests is known. B. B. Morton tells of the role it plays in drilling and production.
Page 24.

CURRENT SITUATION

Outlook.—Promising; prices trending upward.

Crude Market.—Generally strong.

Refined Oil Markets.—Gasoline prices improve further.

Crude Production.—Down 16,075 barrels to 3,418,850 daily.

Crude Runs to Stills.—Down 35,000 barrels to 3,060,000 daily in week ended March 27.

Crude Stocks.—Up 942,000 barrels in week ended March 20; gain of 6,344,000 in 8 weeks.

Gasoline Stocks.—Up 1,915,000 barrels in week ended March 27, to 83,538,000; new peak.

Gas and Fuel Oil Stocks.—Down 696,000 barrels in week ended March 27, to 96,591,000 barrels.

Drilling.—Completions down 19 last week; total 445 wells.

See* MARKET SECTION *for Details

AND we could not dismiss metallurgy without mentioning corrosion: it costs the industry a quarter-billion dollars in a year. But then, of course, they need scrap iron to make steel.
Page 61.

AS was indicated last week, the Senate has given its approval to the committee report recommending that the Connally Act be made permanent. Such act has been passed on to the House for further argument.
Page 10.

A MILLION acres in one lease sounds more like West Texas than Florida. But from that sector comes news of such a block taken by Gulf Oil Corporation. Meanwhile the salt plug in Mississippi has started again the hope that production will be found east of the lower Mississippi.
Page 124.

MOST communities are willing to pay cash bonuses for the prospect of oil production. But not so along the Texas Coast, or at least as regards the open water. Protests have been filed and word is waited from the War Department.
Page 11.

PRODUCTION engineers of the Southwest had a real get together at Dallas last week. Cooperation under the direction of the American Petroleum Institute has had a major part in the advancement of the several departments of the industry, and most notably in production. The good work is continuing. Next week it is at Los Angeles.
Page 14.

Still Face Trial

DEMURRERS TO CONSPIRACY INDICTMENTS OVERRULED

Madison.—Federal Judge Patrick T. Stone of Wisconsin, March 31, overruled demurrers to indictments in the government's "oil conspiracy" case, thereby closing the second-last door to freedom for the 26 major oil companies, three trade journals, and 71 individuals facing charges of conspiracy to artificially raise gasoline prices and to "squeeze out" independent jobbers. Actual trial on the charges remains.

The demurrers, which were the second legal move employed by defense attorneys to avoid a costly and lengthy trial for alleged offenses which leaders in the oil industry declare were identical to practices employed at the request of the federal government under the NRA, challenged the validity of the indictments on the ground that they were vague and did not state an offense.

One set of indictments were previously challenged because of irregularities in the selection of the grand jury which returned them. Although Judge Stone subsequently ruled that the irregular selection of grand jurors did not prejudice the rights of the defendants, government attorneys immediately impanelled another grand jury and obtained similar indictments.

Arraignment April 16

Judge Stone Wednesday also ordered that individual defendants who have not yet entered pleas to the charges be arraigned not later than April 16, at which time he is expected to set the trial date. Pleas of innocent have been entered by 57 of the 71 individual defendants, while the remaining 14 await arraignment.

On April 15 and 16, Judge Stone will also hear arguments on defense motions seeking bills of particulars which would aid defense counsel in preparing for trial. Several other motions of a minor nature are to be disposed of before actual trial, tentatively set some weeks ago for June 1. Observers here believe the trial date will be advanced to July or August as it is believed that neither government nor defense attorneys can complete their preparation by June.

Ehringhaus Declines

That trial of the charges which last year were brought against the oil industry with a great fanfare of publicity is giving the justice department grave concern was made evident March 30 when Attorney General Homer S. Cummings announced in Washington that he regretted "very deeply" that former Governor J. C. B. Ehringhaus of North Carolina had rejected an offer to become the government's chief trial counsel. Cummings made public a letter in which Ehringhaus said: "After the most careful reflection, I still think that, because of the nature of the cases and local problems involved, the government's interest would be better served by the retention of some outstanding lawyer resident in Wisconsin."

In recent hearings before the house appropriations committee at Washington, Assistant Attorney General John Dickinson, who has since resigned, termed obtaining the indictments now pending here the most outstanding accomplishment of the anti-trust division of the department of justice. None of the charges set forth in the indictments have been proven, nor has any defendant admitted they were true.

Judge Gives Opinion

In overruling the demurrers, Judge Stone said he "is of the opinion that the indictment meets the legal test required under numerous decisions of the United States Supreme Court, in that it sets forth the facts which constitute the alleged offense so distinctly and so clearly as to advise the defendants of the charge they are to meet; so fully as to give them a fair opportunity to prepare their defense; so particularly as to enable them, and each of them, to avail himself of a conviction or acquittal in defense of another prosecution for the same crime; and so clearly that the court, on examination of the indictment, may be able to determine whether or not, under the law, the facts therein stated are sunfficient to support a conviction. The indictment charges the defendants with commission of acts which by a law of the United States are made criminal and punishable. This offense is charged in the indictment with precision and certainty, and every ingredient of which it is composed is clearly set forth."

SENATE APPROVES

Connally act as permanent legislation

Washington, D. C.—Continuance of the Connally contraband oil act as permanent legislation was approved by the Senate March 29 and the measure sent to the House of Representatives for concurrence.

There was no discussion of the matter whatever in the Senate, the bill being called when it was reached on the calendar and passed without debate.

When the measure reached the House it was referred to the committee on interstate and foreign commerce, and is expected to be turned over to the oil subcommittee headed by Representative Cole of Maryland for consideration. Hearings are expected to be called in the near future.

The general expectation is that while the House eventually will approve the measure there will be considerable opposition expressed by Representatives from the eastern consuming states.

Electrical Meet

UNUSUAL INTEREST IN SHREVEPORT PROGRAM

Shreveport.— Electrical superintendents of major oil companies from throughout the Mid-Continent area will be in Shreveport April 8, 9 and 10, when the annual convention of the Petroleum Industry Electrical Association is held at the Washington Youree Hotel.

According to Morris Chambers, head of the electrical department of Standard Pipe Line Company, Shreveport, in addition to members of the organization, manufacturers of electrical equipment, especially of that used by the oil companies, will have representatives and displays at the convention.

Officers of the association are F. P. O'Connor, Stanolind Pipe Line Company, Tulsa, president; P. F. Davis, Texas Pipe Line Company of Oklahoma, vice president, and H. E. Browne, Sinclair Prairie Pipe Line Company, Independence, Kansas, secretary-treasurer. Directors are: J. W. Flint, Bartlesville; F. S. Leonard, St. Louis; A. J. Balcom, Dallas; Grover Reid, Bowie, Texas; and D. R. Welch, Independence, Kansas.

Members of the association expected to be here for the convention, include, besides the officers, S. M. Smith, United Gas Company, Houston; R. M. Bayless, Humble Pipe Line Company, Houston; Grover Reed, Lone Star Gas Company, Bowie, Texas; D. W. Sims, Continental Pipe Line Company, Ponca City; F. S. Leonard, Shell Pipe Line Corporation, St. Louis; P. F. Davis, Tulsa; J. W. Flint, The Empire Companies, Bartlesville; C. E. Foster, Oklahoma Pipe Line Company, Tulsa; W. B. Shakeley, Sinclair Prairie Pipe Line Company of Texas, Fort Worth; H. C. Miller, Pure Oil Company, Chicago; A. J. Balcom, Magnolia Pipe Line Company, Dallas; T. J. McMahon, Texas Pipe Line Company, Houston; D. R. Welch, Sinclair Pipe Line Company, Independence, Kansas; H. E. Browne, Sinclair Company, Independence; L. T. Gibbs, Phillips Petroleum Company, Bartlesville; T. J. Colleran, Houston Pipe Line Company, Houston, and Troy M. Oden, Colorado Interstate Gas Company, Colorado Springs, Colorado.

Chambers and H. B. Allen, Arkansas Natural Gas Company, Shreveport, have arranged an unusually interesting program for the three-day convention, all sessions of which will be held at the Washington Youree Hotel.

Transfer Ownership

NEW MEXICO-WEST TEXAS TRUNK AND GATHERING LINES INVOLVED

Houston.—Transfer of The Texas Pipe Line Company's New Mexico-West Texas trunk line system to Houston and gathering lines to the Texas-New Mexico Pipe Line Company, a Delaware corporation owned by four majors, was made effective April 1.

Ownership of stock in the Texas-New Mexico Pipe Line Company is distributed as follows: The Texas Corporation, 55 per cent;Consolidated Oil Corporation, 25 percent; Tide Water Associated Oil Company, 10 percent; and Empire Oil & Refining Company, 10 percent.

Bert E. Hull was elected president of the new concern. The three vice presidents include: A. S. Bailey and Ira McFarland, both officials of The Texas Pipe Line Company, and J. R. Manion, vice president of Sinclair Refining Company, Pipe Line Division, Tulsa. R. B. McLaughlin, The Texas Pipe Line Company, Houston, was elected secretary and treasurer.

Each of the four owners of the Texas-New Mexico Pipe Line Company will have representatives on the board of directors.

The new company acquired a 470-mile, 12-inch trunk line extending from Houston to Crane Station, near the Church and Fields area, Crane County, with a 10-inch carrier extending northwest to Jal, New Mexico. With the exception of the Hobbs and Maljamar fields, the system will serve all oil areas in Lea County, New Mexico.

Permit to operate in Texas was granted the new corporation last week, with an authorized capital of $15,000,000. A permit to operate in New Mexico also was obtained last week.

Necessary extensions and gathering lines will be constructed by the new organization, but no major projects are planned for the immediate future.

TO SPEND $850,000

Stivers to direct work on Texas-Empire

Tulsa.—Approximately $850,000 will be expended within the next few months to complete the expansion program of the Texas-Empire Pipe Line Company of Delaware, with construction under the supervision of F. A. Stivers, vice president and general manager, with offices in Tulsa.

Capacity of the company lines was recently raised from 64,000 to 78,000 barrels of oil daily by looping portions of the main lines. The new plant would increase capacity to 84,000 barrels daily. This would be accomplished by the addition of standby units at several of the main line stations. A new pumping unit will also be built at Mattoon on the Lawrenceville 8-inch line; another unit at El Dorado on the Kansas 10-inch line, the increased capacity being facilitated by intermediate pumping.

Other lines which will be looped include 6.38 miles of 12-inch loop between Hayworth and Fairbury; 1.39 miles of 12-inch loop between Fairbury and Wilmington, and 17.56 miles of 10-inch loop between Manhattan Junction and Lockport.

Actual construction will be done by the present personnel of the Texas-Empire Pipe Line Company. Designs and plans are being drawn up by engineering departments of both companies.

WORKING ON LINE

Santa Maria-Avila carrier due to operate by May 1

Los Angeles.—With work well under way on its $220,000 pipe line project in this area, Union Oil Company expects to start conveying Santa Maria Valley oil to tidewater about May 1. Completion of this line will enable the company to produce Santa Maria Valley wells now shut in for lack of transportation facilities.

The project involves construction of storage tanks, pumping and heating plants in the Santa Maria field and at Summit, near Berros, half way between the oil field and the company's tidewater terminal at Avila, as well as the laying of field gathering lines and a pipe line to connect with the trunk pipe line now operating between Orcutt field and Avila.

The Santa Maria plant will be located in the heart of the valley field on property recently purchased by Union Oil Company from the Battles farm owners. Two storage tanks of 40,000 barrels capacity each will be erected.

Because of the heavy asphaltic content of the oil, heating will be necessary twice in the process of its transfer from Santa Maria to Avila. Direct fire heaters, capable of burning either oil or gas, will heat the oil to 180° F. To prevent vaporization of the oil's lighter fractions, it will be pumped through the heaters under 60 to 70 pounds pressure. Gas engine driven centrifugal pumps operated on natural gas will then send the oil through the pipe line under 800 pounds pressure to the connection with the main line to Avila, about two miles from the field. The process at the Summit plant is identical. Capacity of each plant is 1000 barrels per hour. Eight-inch pipe lines will be used.

To care for the gas output of the wells when they are opened up, Union Oil Company will lay a six-inch wet gas line from a compressor unit at the Santa Maria field plant to the company's absorption plant in the Orcutt field, about six miles south. From Orcutt to Avila, Union already has a six-inch dry gas line and a spur line will be run from this back to Santa Maria to furnish field equipment with dry gas for power. Wells in the field produce only a small amount of gas with their oil, averaging from 100,000 to 500,000 cubic feet, but the gas is rich in gasoline content.

PROTEST PERMIT

Objections raised against proposed wildcat in Gulf

Houston.—Protest against the drilling of a wildcat in the Gulf of Mexico, 4300 feet offshore of Jefferson County and 8 miles northeast of High Island, has been filed at the War Department through the engineering department at Galveston. Humble Oil & Refining Company asked for a permit to drill the test some time ago and Lieutenant Colonel Edwin H. Marks, district army engineer, set March 29 as the last day to file protest.

Protests filed by owners of property around the shores of the Gulf have been forwarded to the company which has answered and returned them to Galveston. The facts and protest of the hearing will be sent to New Orleans and from there to Washington for the final decision. It will be 30 or 60 days before decision is known.

Official and civic bodies from Galveston, Beaumont, Port Arthur and Houston have filed protest against the drilling. It is believed by the group that a grave danger to shipping, beaches and marine life will occur. They stressed the possibilities of pollution in ordinary operations and of far greater damage resulting from wild wells and hurricanes.

However, Humble Oil & Refining Company, counteracted this protest by planning to drill with one of the modernized rigs and with information obtained by other water drilling believe that there is no danger of pollution. Latest standards in drilling equipment and engineering technique will keep the wells from blowing out. Possibilities of hurricanes ruining the well is probable but the company is taking every precaution against this occurrence. Guy wires are placed around the derrick to support it in time of strong winds.

It was stated that a dome was discovered in the area about as large as Sugarland which has an ultimate recovery of around 90,000,000 barrels of oil and if this dome should prove prolific, the state school fund, through its royalty and figuring the oil worth $1.25 per barrel, would receive more than $18,000,000.

A delegation from coastal cities protested to Governor James V. Allred at Austin that although the state authorized leasing submerged lands, reconsideration of the action is urgent.

Governor Allred expressed the opinion that any relief would have to come through the legislature, which authorized the leasing, but arranged for a conference with legislative representatives from the areas involved at which the situation was to be studied further.

Better balancing of crude oil production with demand is in prospect, under new proration schedules prescribed in leading producing states.

April Allowables

By L. J. LOGAN,

TENDING to over-shadow other developments, and promoting optimism in the industry, the April crude production allowables of the leading producing states are particularly encouraging.

The new allowables likely will restore the balance between production and consumption, and therefore stop the running of crude oil into storage, which has been under way for about two months.

May Reduce Stocks in April

There is a possibility, in fact, that some crude will be taken out of storage in April, partially canceling the additions of recent weeks.

This is indicated by the fact that for April the crude allowables are closer to the indicated demand than for any other month this year, being more strict even than the January allowables. Under the January allowables of the states, crude production was restricted to such extent that there was a total withdrawal of about 2,000,000 barrels from storage during the month, in fulfilling the demand.

Recent Excesses to Be Stopped

In February, the state allowables were liberalized, as compared with those in January, as several states particularly Texas, prescribed allocations that more greatly exceeded the Bureau of Mines estimates of demand. Consequently, nearly 3,000,000 barrels of crude oil failed to fit into the consumption picture, and went into storage.

Effective March 1, the allowables of the leading producing states, in the aggregate, were liberalized even further, with Texas again conspicuous in disregarding the federal forecast of requirements. In consequence, March brought a continuation of excessive crude production and further additions to storage.

Effect of State Allowables on Crude Stocks

The comparatively lax allowables of February and March resulted in excessive crude production and running of the excess crude into storage.

April allowables are stricter, however, indicating that additions to crude storage may be eliminated during the month.

DATE	Barrels Crude in Storage
January—	
January 2, 1937	287,659,000
January 30	285,384,000
Change in period	— 2,275,000
February—	
January 30	285,384,000
February 27	288,121,000
Change in period	+ 2,737,000
March—	
February 27	288,121,000
March 13	290,613,000
Change in period	+ 2,492,000

April Allowables Stricter

These unfavorable results of the February and March allowables undoubtedly were recognized by the state authorities when the time for fixing April allowables arrived. For the April quotas that were prescribed are comparatively strict, and probably will hold the nation's crude output within the market requirements.

Accompanying tables show in detail how the state

Monthly Fluctuations in United States Crude Oil Stocks Since Beginning of This Year, By Districts

Figures are from weekly reports of the Bureau of Mines, and indicate barrels of 42 gallons.

GRADE OF CRUDE OIL	JANUARY			FEBRUARY			MARCH		
	January 2	January 30	Change in Period	January 30	February 27	Change in Period	February 27	March 13	Change in Period
Pennsylvania Grade	3,985,000	4,136,000	+ 151,000	4,136,000	4,055,000	— 81,000	4,055,000	4,031,000	— 24,000
Other Appalachian	726,000	801,000	+ 75,000	801,000	882,000	+ 81,000	882,000	858,000	— 24,000
Lima-N. E. Indiana-Michigan	773,000	778,000	+ 5,000	778,000	851,000	+ 73,000	851,000	872,000	+ 21,000
Illinois-S. W. Indiana	9,782,000	9,608,000	— 174,000	9,608,000	9,570,000	— 38,000	9,570,000	9,679,000	+ 109,000
North Louisiana and Arkansas	10,198,000	10,444,000	+ 246,000	10,444,000	10,255,000	— 189,000	10,255,000	9,992,000	— 263,000
West Texas and S. E. New Mexico	28,209,000	27,507,000	— 702,000	27,507,000	28,397,000	+ 890,000	28,397,000	28,399,000	+ 2,000
East Texas	19,338,000	20,047,000	+ 709,000	20,047,000	21,814,000	+1,767,000	21,814,000	22,174,000	+ 360,000
Other Mid-Continent	114,465,000	114,382,000	— 83,000	114,382,000	114,065,000	— 317,000	114,065,000	115,900,000	+1,835,000
Gulf Coast	25,071,000	23,617,000	—1,454,000	23,617,000	24,384,000	+ 767,000	24,384,000	24,778,000	+ 394,000
Rocky Mountain	25,852,000	25,904,000	+ 52,000	25,904,000	25,899,000	— 5,000	25,899,000	25,854,000	— 45,000
California	30,228,000	29,365,000	— 863,000	29,365,000	29,265 000	— 100,000	29,265,000	28,960,000	— 305,000
Foreign	2,082,000	1,645,000	— 437,000	1,645,000	1,334,000	— 311,000	1,334,000	1,566,000	+ 232,000
Total reported weekly	270,709,000	268,234,000	—2,475,000	268,234,000	270,771,000	+2,537,000	270,771,000	273,063,000	+2,292,000
Estimates of unreported stocks	16,950,000	17,150,000	+ 200,000	17,150,000	17,350,000	+ 200,000	17,350,000	17,550,000	+ 200,000
Total stocks	287,659,000	285,384,000	—2,275,000	285,384,000	288,121,000	+2,737,000	288,121,000	290,613,000	+2,492,000

Brighten Outlook

Associate Editor

New allowables provide for strictest control of year. Cessation of crude runs to storage likely, following two months of excessive output.

allowables drifted away from the Bureau of Mines recommendations in February and March, and how crude oil was run into storage in consequence of the liberal allowables. One table indicates also how the state allowables were tightened up for April, in relation to the indicated demand as forecast by the Bureau of Mines.

Six States Dominate Production

Success or failure in balancing the nation's crude oil production with demand depends largely on the state allowables prescribed in the six leading producing states. Those states are Texas, Oklahoma, California, Louisiana, Kansas, and New Mexico.

For April, those six leaders were allocated by the Bureau of Mines a total recommended production of 3,006,600 barrels daily, out of a total for the United States of 3,243,000 barrels daily. The rest of the states combined thus have an indicated demand of less than 240,000 barrels daily in April, and those states commonly have actual crude production fairly close to the federal allocations.

Near Bureau Recommendations

The six leading states for April have combined allowables of 3,102,682 barrels daily, having come within 96,082 barrels or 3.2 percent of the Bureau of Mines recommendations. That is the nearest approach to the federal allocations this year. In January the 6 states had allowables 111,481 barrels, or 4 percent, above the bureau suggestions. But as of March 1, the allowables in the 6 states had expanded until they were 171,742 barrels, or 5.8 percent above the federal allocations.

Texas Cut Back Sharply

The generally brighter picture in allowables for April reflects particularly the more conservative allocations in Texas. The Texas Railroad Commission's proration order that became effective April 1 called for a substantial cutting back of the state's production, and a close approximation to the Bureau of Mines forecast of market requirements.

As of April 1, the Texas state allowable was within 51,064 barrels, or 3.9 percent, of the federal recommendation. On March 1, the Texas allowable was 141,914 barrels, or 11.3 percent, above the federal allocation. In February, similarly, Texas had an allowable materially above the indicated demand.

That the February and March state allowables for Texas were higher than the market justified is proved by the accompanying table showing monthly fluctuations in crude stocks, by districts. Of the additions to the nation's crude stocks in February and March, large proportions were occurring in Texas. The April allowables in Texas are expected to hold output approximately within the market demand.

The other 5 leading producing states, as well as Texas, have comparatively conservative allowables for April, with exception of New Mexico. The latter state, however, has a stricter allowable for April than for March or February, in relation to indicated demand.

State Allowables Compared With Bureau of Mines Recommendations

Leading producing states liberalized allowables in February and March, drifting away from federal estimates of market requirements. Excessive production resulted, and crude went into storage, as shown in another table.

For April, however, allowables are stricter, promising interruption of the runs to storage.

(Barrels Daily)

MONTH AND STATE	Bureau of Mines Recommendation	*State Allowable at Beginning of Mo.	Excess of State Allowable	Percent Excess
January, 1937:				
California	559,900	†551,000	‡8,900	‡1.6
Kansas	165,600	175,851	10,251	6.2
Louisiana	216,300	240,650	24,350	11.3
New Mexico	79,800	92,800	13,000	16.3
Oklahoma	573,100	573,100	.....	.....
Texas	1,176,000	1,248,780	72,780	6.2
Total six States	2,770,700	2,882,181	111,481	4.0
Total Nation	2,998,000	.....	.....	....
February, 1937:				
California	573,300	†551,000	‡22,300	‡4.0
Kansas	170,000	187,918	17,918	10.6
Louisiana	225,100	235,700	10,600	4.7
New Mexico	81,600	97,600	16,000	19.6
Oklahoma	581,900	581,900	.....	.....
Texas	1,203,400	1,329,478	126,078	10.5
Total six States	2,835,300	2,983,596	148,296	5.2
Total Nation	3,068,000	.....	.....	....
March, 1937:				
California	570,900	†551,000	‡19,900	‡3.6
Kansas	178,000	186,968	8,968	5.0
Louisiana	240,000	236,000	‡4,000	‡1.7
New Mexico	88,200	103,200	15,000	17.0
Oklahoma	590,700	620,460	29,760	5.0
Texas	1,256,600	1,398,514	141,914	11.3
Total six States	2,924,400	3,096,142	171,742	5.8
Total Nation	3,159,000	.....	.....	....
April, 1937:				
California	579,900	600,983	21,083	3.7
Kansas	183,000	190,200	7,200	3.9
Louisiana	244,800	235,675	‡9,125	‡3.7
New Mexico	91,400	106,400	15,000	16.4
Oklahoma	609,600	620,460	10,860	1.8
Texas	1,297,900	1,348,964	51,064	3.9
Total six States	3,006,600	3,102,682	96,082	3.2
Total Nation	3,243,000	.....	.....	....

*Allowable indicates daily average for month in California, Kansas, Louisiana, New Mexico, and Oklahoma; except that Rodessa, Louisiana, field allowable increases with completion of new wells; and New Mexico sometimes is revised at middle of month. In Texas, the allowable is as of the first day of the month, and gradually increases as new wells are completed.

† Recommendation of Central Committee of California Oil Producers.

‡ State allowable below Bureau of Mines allocation.

Engineering and Economics

Supply Assured

SOUTHWEST ENGINEERS TOLD THEIR AREA SECURES FUTURE

By WARREN L. BAKER, Editor

Dallas.—The United States may view the question of future oil supply with assurance that it will be forthcoming to meet demand for many, many years; Southwestern states, which already are dominating the industry in this nation, are destined to occupy a greatly expanded position; and taxation is the most important of several influences working against progressive advancement.

These were the outstanding conclusions drawn from a study of a composite picture of present economic conditions, trends and future potentialities of the industry as painted by four speakers before the Southwestern District meeting of the American Petroleum Institute, Division of Production, in Dallas, April 1 and 2.

Economic discussions vied with technical topics for interest at the meeting, and clearly indicated that engineers and other operating men of the industry are aware of the growing importance and closer contact that they must have with such phases of the business.

Important advancements in efficiently discovering, producing, transporting, refining, marketing and using petroleum products were named as factors in considering future supply. Already much progress has been made. This has resulted in finding many fields heretofore passed up, in larger ultimate recovery, in reaching horizons of greater depth, in higher recoveries of gasoline and lubricants from a barrel of oil, in less waste, and in more efficient utilization.

Research at present is working on problems that indicate even more important achievements are to be forthcoming. Along this line, it was pointed out that virtually every calculation of known oil reserves made to date has been revised upwards in the light of additional knowledge developed afterwards.

Southwest to the Fore

Several trends reflect the advance of the Southwest toward a commanding position in the oil-producing industry of the United States. Certain potentialities may be found that indicate this region is fitted to continue in this capacity, it was declared. Only during the past 10 years has it become the largest producing area, the most active from the drilling standpoint, and the storehouse of 58 percent of the already discovered but not produced crude. Its curve of leadership is climbing upward, and no indications of slacking off are yet in view.

Taxation an Obstacle

Taxation was named by several of the speakers as the most serious obstacle of continued advancement. At present producers of crude oil in Texas pass along one-eighth of their income to pay the tax bill. Since 1922 the tax bill in Texas (exclusive of federal taxes) has increased 439 percent, whereas the market value has advanced but 147 percent. This, however, is not the darkest side of the picture—which is that the levies are being increased still further with a regularity that is alarming.

Such other topics as the labor situation and federal government's tendency to invade private fields were also listed as trends and influences working against ultimate success of the industry in providing the most efficient fuel at the small cost. However, the speaker discussing labor did not look with alarm upon this question, because of the record of the industry, and because a healthy condition might be expected to prevail so long as a seasoned restraint, a mutual respect and tolerance, and a just and equitable regard for the rights of others were maintained by both the employer and employed.

Abstracts of all the economic papers presented before this meeting appear in following columns.

★ Science assures future supply of oil

Future supplies of oil can be viewed with assurance, largely because of the scientific progress being made in the industry, W. R. Boyd, executive vice president of the American Petroleum Institute, told the Southwestern District meeting of his organization. Boyd presented an assembled picture of the extent of the industry's progress, but warned that there were certain factors working against ultimate success.

In speaking of the future supply of oil, he said that progress in research as to the derivation and occurrence of petroleum promises to reveal not only greater oil resources, but also to afford new knowledge of physical conditions guaranteeing far more efficient development of oil fields and more complete recovery of oil.

"Your own efforts in developing deep drilling and modern methods both of drilling and production have contributed," Boyd stated, "to this picture of progress. It is reasonable to believe that, as the result of this progress, large pools of oil will be found at depths far below those already penetrated by the drill. Their addition to known reserves awaits only the further development, by you and by others, of the proper technique and equipment.

"Among you are those who, in their daily work, have been and still are contributing to the perfection of means and methods whereby the proportionate recovery of oil from subterranean sands has been increased 50 to 100 percent within the last 15 years. Among you are men who have aided in devising methods for a more efficient and equitable development of new oil fields and for controlling and conserving the natural forces which motivate the movement of oil through sands and which sometimes lift oil to the surface."

Such progress as this, Boyd stated, revealed all the benefits of elimination of

New Officers For

Dallas.—A. G. Levy, senior petroleum engineer in the Shreveport district for The Texas Company, was elected chairman of the Southwest District of the American Petroleum Institute, Division of Production, at the

A. G. LEVY
Elected Chairman

Vie at Southwest A. P. I. Meet

waste and of wasteful methods and has given the United States the assurance of greater ultimate recovery of oil and provided longer life of fields and relief from fears of an early interruption of the flow of oil from well to market.

Known Reserves Only Part of Resources

He pointed out that the best and most accurate modern estimation of petroleum reserves are merely calculations of an extremely limited portion of total petroleum resources, and that so far virtually every estimate made has been revised upward in the light of later knowledge.

The ability to produce oil is being augmented by the abilities of petroleum chemists and physicists in the refining branch, Boyd continued. He spoke of the steadily growing proportion of useful refined products made from given quantities of crude oil.

"The proportionate recovery of motor fuel from a barrel of crude oil today is nearly one half, whereas in 1926 the proportion was only one third and as recently as 1914 was only one sixth. We can," he said, "by practical methods convert

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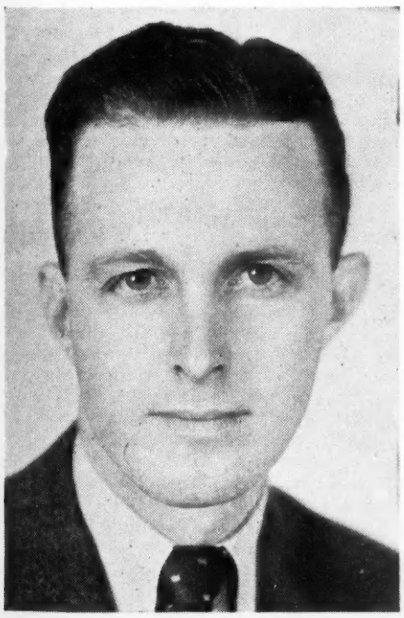
Southwest District

Dallas meeting. Levy was chairman of the district's program committee during the past year. He succeeds R. D. Risser, Shell Petroleum Corporation, Kilgore, Texas, as chairman.

[*Continued on page 18*]



CARL HICKMAN
Elected Secretary

Practical Ideas

ENGINEERS OFFER SPECIFIC REMEDIES FOR DIFFICULTIES

Dallas.—From a technical operating viewpoint the Southwestern District meeting of the American Petroleum Institute, Division of Production, held in Dallas, April 1 and 2, may be correctly designated as a "drilling and producing symposium of recent engineering progress, recommended present day practices and suggested future research work." Not only were recent changes or advancements in several specific field practices or problems reviewed in the technical papers, but in every one there were definite recommendations made for additional needs, together with the suggested trend of future research work and procedures that would result in more efficient field operations.

Prepared Discussions Valuable

Furthermore, the papers discussed current important problems and trends in field operating practices in Southwestern United States. Moreover, as the result of successful planning, prepared discussions of the papers by men familiar with the specific subjects involved naturally added much to their value.

Seven technical papers were presented on the program. Since several of them were prepared by more than one author, they represented the coordinated views and work of 11 men, and at least two persons were prepared in advance to give their thoughts on each paper. In fact, 18 men were listed on the advance program for prepared discussions of one or another of the papers, and, of course, others were given an opportunity and did take part in the "round-table" forum afterwards.

The technical papers were well divided as to drilling and producing subjects, and covered such currently important matters as the following: blowout causes and prevention; control equipment development; foundations for operations in marshy areas; advancements in steam generating plants; bottom-hole well completion methods; capacity pumping of oil wells; and flow of oil and water mixtures through sand.

A brief abstract of all the technical papers follows:

★ Poorly conditioned mud cause of most blowouts

With few exceptions all pressures encountered in the Gulf Coast may be controlled with a margin of safety and blowouts prevented while drilling by circulating rotary fluid weighing approximately 10 pounds per gallon (specific gravity, 1.2), but it is necessary also to adopt certain preventive measures to control a well whenever a blowout threatens. This was the conclusion of Charles B. Carpenter of the United States Bureau of Mines. Carpenter recently made a study of blowouts in the Gulf Coast, and presented his findings before the American Petroleum Institute in a paper entitled "Some Causes of Blowouts During Drilling and Means of Prevention, With Special Reference to the Gulf Coast Region."

The two principal causes of blowouts while drilling are inadequate weight of fluid column and improper consistency of drilling fluids. Since both of these depend upon the condition of the mud, it behooves operators to watch this situation closely. The ability of drilling fluid to perform its desired action depends upon two properties, Carpenter stated. These are weight (specific gravity) and consistency.

Another cause of blowouts is the swab action incident to rapid withdrawal of drill pipe, which may be caused by an accumulation of cuttings around the drill pipe and bit, or by a high-viscosity, high-gel-strength mud. The danger of inducing swab action can be reduced, Carpenter said, by circulating drilling fluid for 30 minutes to one hour prior to withdrawing the drill pipe from the hole, an operation that always should be performed slowly.

Stability of Dispersions Important

"Stability of clay dispersions in a drilling fluid is extremely important," the author continued, "since the fine particles or colloids are employed to suspend solid materials. Frequently this stability is disturbed by the precipitating action of electrolytes, and chemical treatment of the drilling water is required."

Preventive measures considered important by Carpenter, in addition to mud control, were: mechanical equipment, such as pressure-tested casing, fittings, blowout preventers, and valves,

as well as ample drilling fluid available at high pressures.

He declared that "a trained personnel is a primary requisite for the prevention of blowouts while drilling, and the importance of coordination and teamwork cannot be overstressed.'

Carpenter also pointed out the danger of inducing swab action when withdrawing a formation test from the hole is greatly reduced by an equalizing bypass on the formation test and slow withdrawal of the first few stands of drill pipe. He also stated that pressure drilling equipment, which to date has been used largely to control abnormal pressures, offers the safest means of preventing blowouts during drilling.

★ Trained crews, modern devices prevent blowouts

Modern control equipment, together with proper utilization of drilling fluid, will prevent blowouts when intelligently maintained and operated, in the opinion of Madden T. Works of Cameron Iron Works, Inc., Houston, who delivered a paper entitled "The Development of Mechanical Control Equipment Used to Prevent Blowouts."

Works first outlined the early development of control equipment, then gave fundamental principles of efficient blowout control devices and a classification of types. This was followed by the chronological development and improvement of mechanical control, in which he cited cases in which specific blowouts led to particular improvements.

Although it cannot be said that the ultimate has been reached in drilling control equipment, Works did assert that "it is certain that with modern control and associated equipment, intelligently maintained and operated, coupled with a proper utilization of the drilling fluid, the blowout hazard has been reduced materially.

Obsolete Equipment Blamed

Several manufacturing companies devoted to production of drilling control equipment have endeavored to analyze the cause of all blowouts which have occurred in the Gulf Coast area in the past several years. Almost without exception, it has been found that the underlying fault lay in the use of now obsolete equipment which has been superseded by vastly improved and more efficient types. This statement takes no account, of course, of unavoidable blowouts resulting from cratering around the outside of the surface pipe due to surcharged upper water sands."

In the opinion of Works all drilling crews should be trained in proper maintenance and operation of the equipment in use. This would lead to a reduction in the number of blowouts. Along this line of thought he stated:

Training of Personnel

"Drilling control equipment obtainable today is as positive and dependable as it has been possible to produce, but the drilling crews should be unremittingly schooled in the proper maintenance and operation of the equipment furnished them. As has been emphasized by almost every writer on the subject, speed is the primary factor in blowout control, and efficient control equipment is designed around this element. An untrained crew which fails to remain cool and coordinated in the face of a threatened blowout will render the best of equipment useless. Drilling personnel should be kept 'blowout conscious' and possess a healthy respect for ever present dangers. They should have implicit confidence in their control equipment, but not over-confidence to the extent that no maintenance work will be done. The equipment should be tested frequently, but it should be borne in mind that such tests cause wear on even the most rugged packing elements. These should be inspected frequently, and replaced when signs of wear appear.

"The flowline equipment should be inspected frequently and, should the well have blown through them for any length of time, all important nipples and fittings should be replaced, as they may be cut dangerously thin at points which cannot be seen. Valves with metal seats should always be installed in duplicate. When pressure-operated equipment is used on the casing or the flow lines, the locking screws should always be run up after closing so that failure of the pressure supply will not affect positive control."

★ Surface soil tests aid operations in marshes

Before moving into a location in a marshy area, such as found along the Louisiana-Texas Gulf Coast, some investigation should include a study of surface conditions. This was brought out in a paper prepared jointly by W. F. Herbert, engineer for The Texas Company, Houston, and H. E. Anderson, engineer, Texas Creosoting Company, Houston.

Surface condition investigation should include a study of the following: a physical test to determine the bearing capacity of the soil; core drilling to determine the depth of hard-pan or firm load-bearing formation; and a knowledge of the maximum load to be supported; and whether static or kinetic loading.

"The value of such an investigation," Herbert and Anderson declared, "is more than a matter of possible saving in construction (foundation) costs. An accurate knowledge of the supporting effect of the marsh provides a basis for the design and construction of a foundation capable of withstanding operating loads. Structural failures are to be avoided, not only because of the loss of time or well or equipment, but because of possible blowouts and subsequent damages."

Three Types Considered

Three types of foundations were considered in the paper. These were earthen fills, wooden mats and superstructures, and piling. The construction of each was explained briefly. The earthen fill is made by dumping solid materials, such as shells, gravel, stones, sand or clay, on the location. The mat is a system of wooden timbers covering the loaded area upon which the superstructure is to rest. The superstructure is laid as cribbing or fabricated in some structural form that will distribute the concentrated loads of equipment uniformly over the mat. Piling foundations are made up of a series of piles driven in a design conforming to their loading pattern.

Certain characteristics of marshes are valuable in their supporting effects, and are generally to be considered in foundation design selection, it was stated. Grass and grass roots covering most marshes are of particular value, as they afford a means of holding the loosely packed silt in place under the mat. "For this reason practice dictates that neither the grass or the grass roots be removed from the location where a mat is to be used; instead, the grass is bent over and the mat laid on top."

Continuing, the paper stated, "The second characteristic of value is the freezing effect of loose silt upon piling, particularly in those locations where hard-pan is an appreciable distance below the surface. It has been found that piling, which will drive with a minimum drop of the hammer, is capable of supporting an appreciable load after standing for 24 hours. By this means it has been possible to keep the length of piling within the limits of supply and at a reasonable cost, whereas to have used piling long enough to reach hard-pan would have been prohibitive or impossible."

Determining Bearing Value

The authors stressed the importance of ascertaining, if possible, the probable bearing value of the soil before designing a foundation. They stated that in a semi-marsh or wet marsh, it could be done as follows:

"Secure a piece of timber having an area of one square foot or two. Place this on the ground and make a pedestal with a flat table on top. Clear the ground under the foot so that no mat action from the grass will falsify the actual ground bearing test. Guy the above table with wire so as to hold it erect but not down. Load this table with weights of known quantity, such as sacks of cement or mud weighting materials, which weigh approximately 100 pounds each. Measure sinking every 24 hours until relative balance has been reached. Then continue loading until failure of soil is reached. By careful judgment between the first test and the final failure a fairly accurate estimate of the soil bearing can be reached.

"It is recommended," Herbert and Anderson continued, "that all companies operating in the Gulf Coast area, where soil of questionable bearing is involved, make tests of this nature so that a fairly complete record will be available to all operators."

★ Should give more study to boiler improvements

There has been a definite trend of improvement in oil field steam generating plants during the past few years; however, it is evident that there are still several problems to be dealt with in the future, declared George B. Kitchel, engineer, Humble Oil & Refining Company, Houston, in a paper entitled "A Discussion of Oil Field Steam Generating Plants."

In summarizing his conclusions, Kitchel stated:

"The problem of draft is of vital importance and should be overcome so that the size and number of boilers required for a drilling rig can be kept

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Supply Assured

SOUTHWEST ENGINEERS TOLD THEIR AREA SECURES FUTURE

[*Continued from page 15*]

three fourths of a barrel of crude into gasoline, and laboratory experiments have demonstrated the possibility of a recovery of nearly 100 percent."

We are forced to admit, despite all the progress made and anticipated for the future, Boyd stated, "that certain trends and influences work against ultimate success. We must so classify the present tendency, through the medium of excessive and punitive taxation, to divert money to non-productive uses."

Another trend attracting attention is the growing tendency of government to invade fields of activity normally outside its province, Boyd asserted. He made no attempt to moralize upon these two subjects, but pointed to them as factors tending to delay, and even block, industrial progress.

★ Taxes constitute full over-riding royalty

Few oil operators today would be willing to invest money in new properties that involve the payment of an over-ride above the customary royalty, yet, declared Jake L. Hamon, president of the Texas Mid-Continent Oil & Gas Association and himself an independent producer, "that is what the oil producer's tax load is—an over-riding royalty which must be paid out of your (the producers) seven-eighths interest in the oil produced.

"The only difference in this case, however," he continued, "is that the amount you pay in taxes is not fixed at a definite percentage like an over-riding royalty, but may be increased at will whenever an additional levy is made by taxing authorities."

Hamon quoted statistics to show the vast amount of taxes paid by the Texas petroleum industry, among which were figures to show they virtually constitute an over-riding royalty of one-eighth over and above the usual fee royalty paid to the land owner. Hamon also discussed the many benefits that have come to the state through oil development, the effect of imposing too heavy a tax burden upon an industry, and Texas' needs for new industries and new capital for old industries. He recommended that the tax load be shifted to John Public, and that the latter would be fair about it if the full facts were presented.

Increased 439 Percent Since 1922

Oil producers in Texas now are paying $5.39 in taxes for every dollar of tax paid in 1922, an increase of 439 percent, Hamon pointed out. During the same period the market value of Texas oil has only increased 147 percent.

"One item alone," he continued, "is at present costing the industry $14,200,000 a year." He was referring to the gross production on crude oil of the state, which has increased 81.3 percent in two years.

"Levies made directly by the state against Texas crude," he said, "now aggregate more than $16,000,000 per year, while the proportion of advalorem taxes collected by counties and turned over to the state boosts the state's share of the oil production tax to nearly $21,000,000. And when the local taxing agencies' levies are added, the producers of the state pay the staggering sum of nearly $39,000,000 per year. Thus with an average barrelage tax of 8.6 cents per barrel the state is now receiving 4.5 cents in production tax."

14 Cents Per Barrel Some Places

Hamon analyzed tax payments to show that in many counties imposition of high advalorem taxes causes the producer to pay as much as 14 cents per barrel. In 40 counties in Texas the average tax rate is 11 cents per barrel produced. In Montgomery County, which has an average tax of 14 cents a barrel, from 40 to 50 days entire production is required to pay the tax. In Eastland County, an old stripper well area, taxes are 13 cents per barrel.

In addition to the taxes paid to the state of Texas there are federal taxes to be taken care of. During 1936, federal taxes in Texas averaged from 5 to 5½ cents per barrel. "This means that the average Texas oil operator is now paying 14 cents in taxes for every barrel he produces. It means, furthermore, that producers who operate in the high tax counties are paying as much as 16 to 19 cents per barrel!"

This represents only one side of the oil tax picture—the producer's side. If all the taxes, state, county and federal, that are paid by all branches of the industry, together with state and federal taxes collected on gasoline and lubricating oil are added together, the average tax per barrel of crude oil is $1.14—which is within one cent of the average market price of Texas crude today!

"In the final analysis," Hamon stated, "the money we receive for Texas crude oil comes from the pockets of those who consume gasoline in other states than our own. If, because of high tax costs, the consumers cannot afford to pay a reasonable price for gasoline, the retailer cannot make a reasonable profit. If the retailer cannot pay the refiner a reasonable price for gasoline, the refiner cannot afford to pay you a reasonable price for your crude oil."

★ Southwest to continue to dominate U. S. oil supply

The Southwest has become the nation's principal source of petroleum, and potentially it is fitted to continue in this capacity, and its domination in this respect may become even more complete. These were the words of Wallace E. Pratt, vice president of Humble Oil & Refining Company, in discussing the trends and potentialities in oil development in the Southwest.

Pratt based his remarks upon some interesting figures and trends.

In discussing the situation as based upon past performances, he declared, "Within the United States as a whole, over the entire life of the oil-producing industry, we have discovered nearly 32,000,000,000 barrels of oil. Some 13,000,000,000 barrels of this total is still available for use, remaining undisturbed in natural reservoirs underground as our proven reserve. The balance has already been consumed. In the Southwest our total discoveries, up to the end of 1936, amount to 13,500,000,000 barrels, of which 7,500,000,000 barrels are still held in reserve. Thus the Southwest has accounted for 42 percent of our total discoveries, and possesses 58 percent of our present proven reserve. Whereas the national reserve constitutes but 69 percent of its past production, and the national reserve, excluding the Southwest, constitutes but 43 percent of past production, the Southwest's reserve is 125 percent of its past production. In 1936, the Southwest supplied 539,000,000 barrels of the 1,089,000,000 barrels of oil produced by the nation as a whole. Currently, then, the Southwest furnishes almost exactly 50 percent of the oil the nation uses.

Southwest Supplies Half

"From these figures potentialities begin to emerge. The Southwest supplies one-half our oil today and holds in trust nearly 60 percent of the nation's proven reserve against its future needs. On the basis of these figures alone, the Southwest is destined to occupy an expanding position in the national enterprise of producing oil. But trends are also discernible in the record of past performance of the industry. Ten years ago the Southwest contributed only 32 percent of the oil used by the nation, and its proven reserves were only 36 percent of the nation's total."

Pratt stated comparisons of the record of discoveries of oil fields was of more significance than the foregoing figures on past production and proven reserves in looking into the future. Along this line of thought, he spoke these words:

"Of the roughly 15,000,000,000 barrels of oil discovered in new fields in the United States in the last 10 years, 60 percent was found in the Southwest. During the preceding decade, with total discoveries aggregating less than 10,000,000,000 barrels, the Southwest accounted for only 38 percent of the total, or 3,600,000,000 barrels. The Southwest, then, has become pre-eminently the nation's hunting ground for new oil fields."

Other trends also reflect this advance, Pratt declared. For example, the drilling of wells for oil centers ever more largely in the Southwest. Up to 1927, only 12 percent of the wells in the United States had been drilled in the Southwest, but over the last 10 years, 48 percent, and over the last 5 years 59 percent of all wells drilled were located in Southwestern states. Similarly, he pointed out, the number of producing oil wells in the Southwest has increased from 41,000 to 75,000 in the last 10 years, an increase of 83 percent, compared to an increase for

the nation at large during the same period of only 6 percent.

Pratt included the states of Arkansas, Louisiana, New Mexico and Texas in the region he termed the Southwest.

★ Employer and employe trustees for consumers

"It is well for both the employer and the employed in the oil industry to remember," it was asserted in a brief speech by George A. Hill, president of Houston Oil Company of Texas and vice president in charge of production for the American Petroleum Institute, "that there are great armies of workers who invent, forge and fashion the many thousands of serviceable tools and facilities that implement our great industry, and who justly and equally share in the credit for the results achieved, and that we are all, in effect, trustees for the consuming public who have a direct, immediate and intimate stake in the orderly and undisturbed continuance of our business."

The record of the industry, with respect to hours, wages, working conditions, insurance benefits and various other humanitarian activities, Hill declared, would indicate an acute sensitiveness to and regard for the welfare of the employed by the employer.

"If it should be contended that this has not been manifested to its ultimate degree, it nevertheless furnishes indisputable proof that there exists upon the part of the employer, generally, the ability and willingness to improve the various phases of the relationship between the employer and the employed, in our industry, and this has been true through a long continuing process of improved relations," Hill continued.

"It is likewise and equally true that the employed, in our industry, have, through increasing skill, energy and fidelity, rendered an increasingly effective service and have been important and responsible partners in the erection of our great industrial structure. They have exhibited a degree of considerateness and understanding that has proven indisputably their recognition of the mutuality of the interest of the employer and the employed."

Hill asked if it were likely in view of the past that out of the unrest that is in the air affecting other industries, an issue may be suddenly precipitated in the oil industry that will substitute distrust for understanding, arbitrariness for human sympathy and interest, and a public-be-damned attitude for the present zealous devotion to public service.

He answered this question with the statement:

"What the future holds in store no one of us can precisely foresee, but we are justified in the confident expectation that the employer and the employed, in our industry, will continue to display that wisdom in action that has characterized their past relationships, if both groups shall be guided by the criteria of their past relationships—a seasoned restraint, a mutual respect and tolerance, and a just and equitable regard for the rights of others."

New Officers for Southwest District

[*Continued from page 15*]

Six vice chairman were elected, each one to be in charge of one of the areas comprising the Southwest district. Vice chairmen and their assigned territories are as follows: W. S. "Buck" Morris, East Texas Engineering Association, Kilgore, for East Texas; George B. Corliss, Humble Oil & Refining Company, Houston, for South Texas; Harvey H. Hardison of Standard Oil Company of Texas, Midland, for West Texas; C. G. Staley, Lea County proration office, for New Mexico; W. C. O'Ferrall, Lion Oil & Refining Company, El Dorado, for Arkansas; and W. A. Alexander, Shell Petroleum Corporation, Iowa, for Louisiana.

Carl Hickman, with Dewey T. Ross, Inc., Houston, was elected secretary.

The following men were elected to the advisory board: R. D. Risser (chairman), Shell Petroleum Corporation, Kilgore; R. E. Allison, independent operator, Shreveport; J. A. Bermingham, The Texas Company, Houston; E. H. Blum, Atlantic Refining Company, Dallas; A. R. Campbell, Mid-Continent Oil & Gas Association, Shreveport; M. G. Cheney, Anzac Oil Corporation, Coleman, Texas; Sid Childress, Rio Bravo Oil Company, Houston; J. D. Collett, Collett & O'Keefe, Fort Worth; E. De Golyer, Felmont Corporation, Houston; Charles Fitzgerald, Sinclair Refining Company (pipe line department), Fort Worth; C. L. Gladden, Magnolia Petroleum Company, Dallas; Rex G. Hamaker, Reed Roller Bit Company, Houston; R. H. Hargrove, United Gas Public Service Company, Houston; J. S. Hasson, The Ohio Oil Company, Shreveport; H. J. Hawley, Standard Oil Company of Texas, Dallas; C. W. Hughes, Arkansas Natural Gas Company, Shreveport; J. C. Johnston, Continental Oil Company, Fort Worth; R. B. Jones, Panhandle Refining Company, Wichita Falls; J. W. Jordan, Sinclair Prairie Oil & Gas Company, Midland; E. A. Landreth, Landreth Production Company, Fort Worth; A. G. Levy; R. S. McFarland, Seaboard Oil Company, Dallas; F. R. McGrew, Standard Oil Company of Louisiana, Shreveport; J. R. McWilliams, Standard Oil Company of Louisiana, Shreveport; L. M. Moffett, Triangle Drilling Company, Shreveport; J. A. Ritter, Sun Oil Company, Dallas; C. F. Roeser, Roeser & Pendleton, Inc., Fort Worth; A. H. Rowan, Rowan & Nichols Oil Company, Fort Worth; J. H. Russell, Gulf Oil Corporation, Houston; E. H. Salrin, Tide Water Associated Oil Company, Houston; John R. Suman, Humble Oil & Refining Company, Houston; Chase E. Sutton, Pure Oil Company, Houston; Ted E. Swigart, Shell Petroleum Corporation, Houston; and W. L. Todd, Columbia Oil & Gas Company, Dallas.

CLARIFY RULE 37

Texas Commission order interprets "conditions"

Austin.—The Texas Railroad Commission has issued a new order further clarifying its interpretation of Rule 37—the spacing rule.

The order applies to permits for which application has been denied. It sets out the commission's interpretation of "changed conditions" under which a rehearing on these applications may be had. The new regulations are as follows:

"1. Any material change in the physical conditions of the producing reservoir under the tract under consideration or under the area surrounding the said tract which would materially affect the recovery of oil from said tract.

"2. Any material changes in the distribution or allocation of allowable production in the area surrounding the tract under consideration which would materially affect or tend to affect the recovery of oil from the given tract.

"3. Any additional permits granted by the commission or wells drilled in the area surrounding or on offset tracts to the tract under consideration which would materially affect or tend to affect the recovery of oil from the given tract.

"4. Any additional facts or evidence thereof materially affecting or tending to affect the recovery of oil from applicant's tract, or the property rights of applicant, which were not known to and considered by the commission at any previous hearing or application thereon."

Railroad Commissioner Ernest O. Thompson explained that under these regulations an operator might be entitled to an additional well on his lease, if he could show that his situation with relation to pressure was unfavorable. That is, if he could show that pressures on his lease were materially higher than those on adjacent properties, then he might be entitled to an additional well to prevent migration of pressure and oil from his lease to other leases.

DELAY TAX RAISE

Austin.—The Senate State Affairs Committee has postponed until April 13 further hearings on the 6-cent oil tax.

The first hearing was held before the committee on March 31, and members of the State Affairs Committee indicated clearly that they were not anxious to put an additional tax on the oil companies. Only 2 of the 9 members who took an active part in discussion favored any increase at all, if their questions indicated their true attitude in the matter.

The day following this meeting, Representative Harry Graves of Georgetown, chairman of the House Appropriations Committee, condemned the Senate for delaying action on this bill and suggested that the House postpone work on all Senate bills as a means of bringing pressure on the upper House.

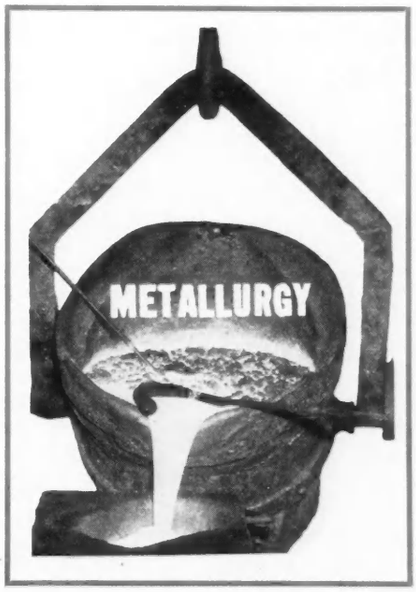
Some 50 oil men were prepared to testify before the Senate committee last week, but there was no time to hear any of them, and they were invited to return on April 13.

Growing Use of Alloy Steels in Field Equipment

By HARRY PENNINGTON,
Mechanical Engineer, San Antonio

THERE are many efficient oil field tools and appliances that if made of mild steel would not be at all successful, but made of alloy steels with their properties fully developed by proper heat treatment, these tools and appliances are of inestimable value in deep wells. We take them for granted, but this article will take them apart to indicate what metallurgists, steel makers, and engineers have done toward making deep wells commercial.

In tool joints a chrome nickel forty carbon steel (SAE 3140) is frequently used. This steel furnishes first, extreme reliability; second, great strength; third, resistance to wear. Composition is on the following basis: 1.25 percent nickel; 0.06 percent chromium; and .40 carbon. The percentages of nickel and chromium are small, to be sure, but it is like leavening in bread—without them, an ordinary steel; with them, a super-steel adapted to shock by way of preventing breakage.



The modern, high-speed giant oil bath rotary owes its successful performance to alloy steels for the gear sets, the main roller thrust bearings, the shaft and shaft bearings, and the steel castings. The linear speed of the gear set in a 26-inch oil bath rotary approximates 2800 feet per minute—for these machines are now currently rotated at 200 revolutions per minute and more, enabling truly vertical well drilling, and rapid work. And a super-roller bearing is necessary to support the 3500-pound table in rotation. Such a bearing is procured through the use of heat-treated alloy steels, while roller bearings are taken for granted on the rotary drive shaft.

Next in the Society of Automotive Engineers series is the 4000 series, which in addition to nickel and chromium, has a dash of molybdenum added—resembling the finishing touch of a noggin of kirsch on a crepe suzette. SAE 4140 has the following composition: chromium, 0.80-1.10 percent; molybdenum 0.15-0.25 percent; carbon, 0.40 percent. SAE 4650 composition is as follows; nickel, 1.65-2.00 percent; molybdenum, 0.20-0.30 percent; carbon, 0.50 percent. Ever so small a percentage of molybdenum, but such a great change in the steel; a wide quenching range with less danger of hardening cracks; excellent machining qualities even though left hard after quenching—this steel machines at 400 Brinell quite readily. Great resistance to shock—in short, a tougher, stronger steel that can be relied upon in any sort of a pinch.

But, you may ask, why all these steels, and these figures. Simply that without them, your automobile would weigh easily twice as much, and likewise, your oil field machinery weighs twice, yes, three to four times as much without these fine alloy steels, and the cost is much greater, too.

You give no thought to the shanks of your drilling bits because they very rarely ever break off now, in the roughest drilling, but before the use of alloy steels, and before heat treatment, shank failures and fishing jobs were too numerous to be comfortable.

Comparative Strengths

By way of comparison, here is a curve (Figure 1) showing the strength of a mild carbon steel, SAE 1015, and a fine grade of alloy steel, SAE 4340. And remember that the fine alloy steel is made simply by adding two fingers, so to speak, of nickel, chromium, and less than a quarter of a finger of molybdenum, to the same mild carbon steel, to produce, the fine steel. Where the 1015 steel shows a yield point of 63,000 pounds per square inch, the same steel with the alloys added, rises to 193,000 pounds yield point, drawn at 800° F. after quenching. Here we have three times as much strength for only twice the cost—a bargain in strength, for, after all, we buy strength when we buy steel for anything, and in designing a part, we proportion the steel according to its strength. But strength is not all that is obtained in the bargain; we get toughness, extreme reliability, shock resistance, resistance to fatigue, in a way impossible otherwise.

But these are not the strongest of steels; the current ranges in the 3000 and 4000 series are steels made in large quantities in the open hearth. There are especial steels for strength, shock resistance, that will show an elastic limit approximating 350,000 pounds per square inch, which is something else again—permitting designs of tools, appliances and

FIGURE 1

equipment as to certain parts that otherwise would be impossible, and yet, because of the higher unit strength, such high strength steels, though greater in cost per pound, are lower in cost per unit of strength.

Heat Treatment

Let us first distinguish in heat treatment. To heat a piece of steel and allow it to cool is a sort of heat treatment, but not the sort covered by the general term of heat treatment. Heat treatment means the heating of a steel to the critical point, or that point at which the carbon content combines with the iron to form a particular grain structure, which, by quenching, is fixed, after which the steel is tempered according to requirements, but not so much as to change the particular grain structure furnished by the composition of the steel.

Certain steels, particularly those in the molybdenum or "moly" group, will air harden to a certain extent when heated and allowed to cool in the air. But that, by no means, is heat treatment, although it may be so claimed, because the maximum strength, the maximum resistance to shock, the maximum resistance to fatigue, cannot—positively cannot—be procured except by heating so as to change a coarse grain structure into a fine grain structure and then to fix that fine grain by quenching in a bath of water or oil, followed by tempering to requirements.

After thus quenching, all steels are more or less brittle, requiring tempering to remove brittleness. A 0.40 percent carbon chrome nickel steel (SAE 3140) when quenched at 1550° F., will show an elastic limit approximating 240,000 pounds per square inch, but it must be tempered to remove brittleness, by way of imparting shock resistance. And if extreme resistance to shock is required, it would be tempered at about 1000°F., which reduces the yield point to some 130,000 pounds per square inch, at which a very safe steel is acquired. But, for toothed gears, the tempering would be done at about 800°F., to leave a Brinell hardness approximating 400, at which the elastic limit will be 145,000 pounds per square inch.

Hardness

Hardness, produced by combining carbon with iron, to a certain extent expresses the elastic limit of a steel. Several hardness testers are available, including the Shore instrument wherein a hardened steel ball is bounced on the steel to be tested, the hardness being expressed in terms of how high the steel ball bounces. Then there is Dr. Brinell's machine wherein a steel ball is pressed into the steel to be tested, with a pressure of 3200 kilograms (one kilo being 2.2 pounds). The depth of the impression varies the width from edge to edge, and the width is measured, and translated into a set of numbers, —Brinell number. Somewhere just above 90 in the Shore instrument, and above 675 in the Brinell machine, corresponds to the hardness of glass, by way of illustration.

A 0.15 percent carbon mild steel will not harden when heated and quenched; a 25 carbon steel hardens somewhat, while a .40 carbon steel hardens to 600 Brinell. Then there are the ball bearing steels, with 1.00 percent of carbon, that assume great hardness, and therefore, great resistance to wear, when quenched and slightly tempered. Cast iron, or grey iron, has 4 percent or more of carbon, differing only in this respect from steel.

Impact Value

Impact value, or resistance to shock—a most important consideration, and a very valuable quality in steel, is measured by dropping a swinging weight upon a test piece of the steel, and calculating the energy required to fracture the test piece. Spring steel, for example, has a low impact value compared with a mild steel, but other properties of the spring steel render it valuable. As the impact value of a steel rises, by increasing the tempering temperature, the elastic limit and the ultimate strength lower.

And herein is the skill of the metallurgist and the engineer required, to proportion shock resistance and strength, sacrificing one somewhat, to obtain the other. And it seems that experience is the sole measure of such proportion. Some years ago, for example, the writer designed a heavy-duty transmission gear set for a drilling rig, powering it with a 60-horsepower four-cylinder engine. Nothing happened; the gear set operated without distress. Subsequently, the same gear set was powered with a 75-horsepower engine, then with a 100-horsepower and finally with a 125-horsepower six-cylinder engine, and still nothing happened; there was no sign of distress, no wear of consequence, no fracture. And from this a formula was derived as to the allowable stresses that may be imposed on such gears for rotary drilling work, in none of which has there been a failure or the least sign of distress. There is no substitute for experience.

Special Process

A process has been recently developed for the surface hardening of large pieces without heating and quenching and drawing—quite a simple process. In fact, so simple that we wonder why—

Take for example, the large ring gear for a high-

speed oil-bath rotary. Its diameter, let us say, is 56 inches; the width of the tooth face is 6 inches; the teeth one diametral pitch. A rather large ring gear as ring gears go. To heat it and quench it, after machining the teeth ever so accurately, will distort the gear, make the gears mesh noisily, unless the gear and pinion are lapped in by running them with oil and abrasive until the noise disappears. All in all, quite a costly gear.

This new process consists in eliminating the heating, quenching, tempering and lapping in, and using instead, an especially designed acetylene torch which has a number of fine streams of flame. Running this over the gear tooth surfaces, slowly, just fast enough to heat the surface quickly, then allowing it to cool —it quenches from the heavy body of steel beneath the surface heated—the surface is hardened just right and with extreme uniformity without a liquid quenching bath. Quite simple—when done right. And there is no measurable distortion of the ring gear when it is thus surface hardened, while the base—the steel below the hardened surface—is left relatively soft with all its shock resistance, ready for years of hard usage at high speed without failure.

Carburizing (Case Hardening)

Another development for steels requiring extremely high strength, coupled with great surface hardness, secured formerly with low carbon steels, consists of using medium carbon alloy steel, say SAE 3140, or 6150. By heating a finished piece imbedded in carbonaceous material—or, let us just say plain charcoal for short—for several hours at 1550° F. to 1600°F., the carbon content of the surface is increased to 100 or more. Quenching, and then drawing at low temperature, say 400°F., the surface is not made soft, but is left hard, while the core has its brittleness removed by the tempering process, and lo—we have an automobile gear that will make you forget you have any in your transmission, for they will give no trouble.

Nitriding

Still another process, nitriding, which imparts a surface hardness equal to, sometimes exceeding that of a carburized surface. An advantage of nitriding is that the temperature required is much lower than for carburizing, and where distortion is a factor that cannot otherwise be remedied, nitriding offers much in certain parts used in oil field machinery, equipment, tools, appliances.

Gas Carburizing

One more special process, and we leave this subject. By heating steel in an atmosphere of natural gas, carburizing is accomplished in the same manner, but in less time, than when carburizing with charcoal. Gas carburizing, like nitriding, lends to quantity, or mass, production.

Furnaces

For quantity production, salt bath furnaces are obsolete, but the fact remains, however, that for particularly important pieces—pieces with uneven sections, say like a die used in drop forging work—a salt bath furnace affords an accuracy, a uniformity, not secured with any other type of furnace whatsoever.

There are continuous gas-fired furnaces in which a moving belt carries pieces through and dumps them off into a quenching bath; electric furnaces that do the same, and all these are subject to automatic temperature control within close limits, with some of them controlled as to the furnace atmosphere. If a flame heated furnace carries an oxidizing atmosphere, there will be a surface decarburization of the steel pieces being heat treated—some steels suffering surface decarburization more than others. This surface decarburization means a soft skin, and in certain cases, a soft skin tends toward galling—as in threads for example. Maintaining a reducing flame eliminates soft skin; the salt bath furnace never decarburizes, for no flame contacts the pieces being treated.

Drill Pipe

For over a quarter century, the writer has been critical of drill pipe, from the ore through the smelter, through the steel mill, through the pipe mill, and on into the well, even as to handling finished pipe in transit. We cannot be too critical, because we hang our money on the end of drill pipe in a well. Only top flight performance will satisfy a requirement that deep drilling be made safe to make it commercial. And, comparing really top flight steels and heat treatment, with what we have in drill pipe, the field is not yet even in the third flight—yet a dub is what I would call it.

Rotary drilling began with internal flush, welded seam, wrought iron pipe, without tool joints—and a deep well was a thousand feet. Next came seamless drawn pipe made of a plain, low carbon (0.15 percent) steel, which was an improvement. Then internal upset ends. But this mild steel, and all mild carbon steels, are peculiarly subject to fatigue, when stresses are repeatedly applied, and reversed, when drilling. We then demanded medium carbon steel (0.35 percent) in seamless drawn internal upset drill pipe, which was in 1912, securing somewhat better performance, although supplied with reluctance. Then, 11 years ago, on demand, a 0.50 percent carbon heat treated steel in drill pipe furnished a performance never before surpassed; where a string of pipe made of untreated 35 carbon steel made three wells and began twisting off, the 50 carbon treated pipe made nine wells and was still in fine shape without twisting off, in the same field.

The little pipe mill that made that heat-treated 50 carbon steel drill pipe, bounced out into the spotlight, all dressed up in tights and stole the show—completely, but believe it or not, that pipe is not available today—discontinued, and without even a mention of such specification by the American Petroleum Institute. All the seamless pipe mills making drill pipe offer this or that A.P.I. grade, and so long as this practice is continued, we are positively not going to have any better drill pipe.

Let us examine into the difference in specifications. We say S.A.E. steel, and furnish a number—for example, S.A.E. 4650. Examining the pedigree of this number, we do not find it crossed with a scrub breed; it is a breed of its own, and like all fine breeds, it is improved by environment provided its heredity is without suspicion. Impelled by necessity, the automotive industry developed engineers and metallurgists who led the way for steel makers, first, and then demanded a following. And they got it, establishing by sheer ability, unvarying top flight performance, a new strain, new breeds, of steels

which by comparison with the steels used in drill pipe, are such that the oil field is a laughing stock. And no foolin'—there is as much difference in these steels as there is between the cuisine on a French Liner and in a detention camp.

The American Petroleum Institute Specification No. 5-A, sets out four grades, A, B, C and D for seamless and electrically welded drill pipe, as follows:

Chemical Properties	Grade A	Grade B	Grade C	Grade D
Manganese	.30-.60	.35-1.50	.35-150	Mfrs. Option
Phosphorus, not over	.04	.04	.04	.04
Sulphur, not over	.06	.06	.06	.06

Physical Properties	Grade A	Grade B	Grade C	Grade D
Minimum tensile strength	48,000	70,000	75,000	* 95,000
Yield point	30,000	40,000	45,000	55,000
Elongation in 2"	40%	25%	20%	18%

There is not even a hint in this specification as to just what kind of steel is used for these four grades, or why the four grades. Certainly, we can assume that there is no beneficial alloy, for alloy steels cost somewhat more than carbon steels; there is not even a statement of the carbon content.

But take the best of the lot, Grade D, as indicated by its higher minimum strength—a yield point of 55,000 pounds per square inch. And here, let me say, that yield point is a more correct measure than the tensile strength, for after a steel begins to deform under stress—which is at the yield point—it is of no further value, because distortion and deformation invariably weaken steel.

The manganese content—some manganese at least is required for manufacturing steel, whether specified or not—in Grade D pipe is increased over the requirements of the steel maker to furnish a measure of air hardening, without heating, quenching and drawing.

And while manganese in steel is an alloying element, this is *not* alloy steel as the term is used, for all true alloy steels must have manganese, too, for the steel maker's requirements.

The air hardening, in a .50 carbon steel, then, increases the tensile strength somewhat, over that of a plain, normalized, normal manganese content steel, but, if the manganese content is normal, and the same steel were quenched and drawn or tempered to a safe impact value, its tensile strength can be thus increased from 95,000 to 125,000 pounds per square inch and its elastic limit advanced from 55,000 to 90,000 pounds—a clear net gain in elastic limit of some 60 percent. And the cost of this 60 percent gain in strength would be but $15 to $18 per ton.

But, let us go further, and examine a drill pipe made of S.A.E. 4650, the composition of which is: Carbon, .45-.55 percent; nickel, 1.65-2.00 percent; molybdenum, .20-.30 percent. Quenched and tempered at 800° F., this steel, made into seamless drawn tubes, shows an ultimate tensile strength of 200,000 pounds, and an elastic limit of 180,000 pounds, which is a gain in elastic limit of some 300 percent over the A.P.I. specified strength, but at a cost approximating only about 45 percent more than the .50 carbon steel. But this gain is not all; there are other and more important improvements, aside from mere strength.

Drill pipe does not wear out; it fatigues out. Fatigue, or in plain words, crystallization as the field term goes, comes about when pipe is subjected to repeated and reversed stress or, is stressed above its elastic limit; the grain structure is deformed, the pipe becomes brittle, and unsafe, therefore, unserviceable. Low carbon steels in particular are in this class of steels subject to fatigue. When drill pipe is set down on bottom, and then raised up off of bottom, the stresses imposed on it are reversed, and reversal of stress can do more damage than a higher stress in one direction only. Then, the stresses vary with the drilling, the torque required to drill, while whipping the pipe in the hole—which at times is unavoidable—is a further reversal of stress many times repeated. Drill pipe, therefore, fatigues, made of plain carbon steel.

But add molybdenum, and we get not only strength, but a far greater measure of resistance to fatigue, and the nickel, in the above moly steel, emphasizes the molybdenum, as a sort of leading lady. In tests for fatigue, made by repeated reversals of stress, repeated millions of times, in test machines especially for the purpose, moly steel shows a value far beyond its cost in comparison with plain carbon steels.

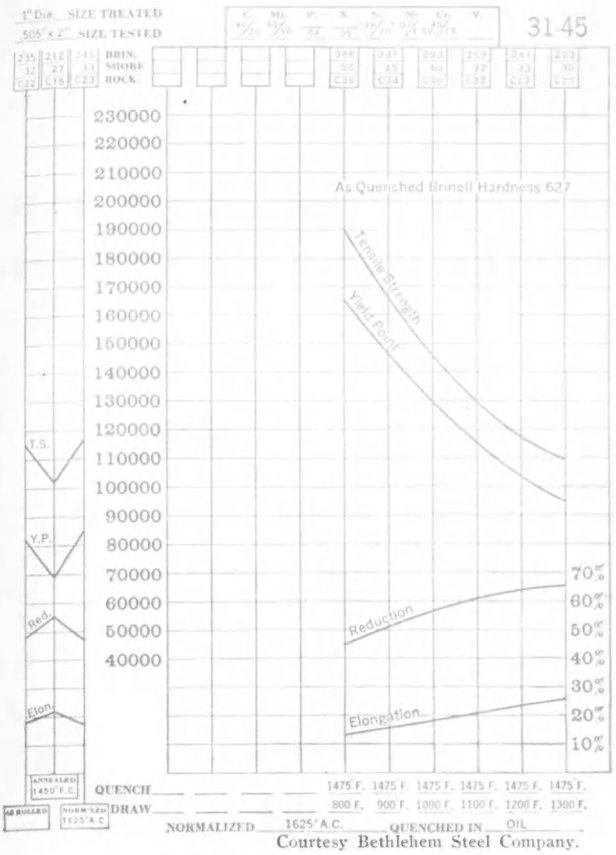
Further, moly steel machines smoother, and the threads obtained are less subject to fracture by the chasers used for cutting the threads. The same length of thread furnishes a proportionate pull out strength, far greater in the moly steel.

Then, why not moly steel drill pipe, you ask? You have not demanded it. When wells are drilled to 20,000 feet, the drill pipe will not be a plain carbon steel; it will through necessity, be made of a nickel molybdenum steel, or a better steel, if such is available.

Shafts

The large diameter shafts of draw works for steam driven drilling rigs are a headache—unless correctly made of a carefully selected, carefully heat-treated steel. The diameter, maximum, of drum shafts will soon be 12 inches—quite a shaft in anybody's language. Last year the writer examined some shafts on board a transatlantic liner which were transmitting 24,000 horsepower each; they were in sections totaling about 200 feet long, and 20 inches in diameter; they ran perfectly true, without vibration, even though carrying 16-foot propellors. But they were not solid shafts; they were hollow bored, and only by hollow boring and heat treating could these shafts transmit the high torque imposed upon them.

Heat treatment, at its best, penetrates with a proper grain refining effect, to only about two inches maximum depth from the surface. Various factors prevent further penetration. So, a 10-inch diameter shaft, such as currently used for drum shafts, will not yield to heat treatment through and through, when made solid as all of them are today. But, bore a hole through them, a 3-inch diameter hole, and then heat treat, and the heat treatment penetrates inwardly as well as outwardly from the bore, and a uniform grain structure may thus be secured, and thereby, all the advantages of high strength are furnished. Further, after quenching and tempering for high impact value, internal stresses are removed and the shaft will not kink in service, due to heating of the brake flanges in turn heating the shaft. A 9-inch



Courtesy Bethlehem Steel Company.

Physical Properties Chart S.A.E. 31-45

shaft made of SAE 4140 forging, hollow bored, heat treated, then machined, will show as much strength as any 12-inch diameter, solid, mild carbon steel, untreated steel shaft; will weigh almost half as much; while the safety against distress, fracture, kinking is far greater in the alloy steel shaft, hollow bored and heat treated. Then why not hollow bored, heat treated shafts, you may ask? Inquire of your manufacturer.

Making Steel

Cast iron, with its 4 percent or so of carbon, requires reduction of the carbon content to make steel of it. The open hearth steel furnace makes most of our steel because it is subject to accurate control, it removes impurities to definite maximum limit enabling the use of lower grades of pig iron, and it lends to mass production.

Electric furnaces simply melt steel, and while melted, alloys may be added, the product being no more nor less than charged into the furnace, there being no refinement. Steel castings thus poured may be hot worked into shapes required; great quantities of steel castings are made and used in the oil field, from electric furnaces.

Hot Working of Steel

After steel is manufactured in the open hearth—most of our steels come from the open hearth—it is run into molds, the ingot mold, becoming merely a steel casting the upper end of which contains impurities, pipes which tend to gather at the top of the ingot, requiring cutting off the upper end, of cropping, the percentage thus cut off depending upon the quality of steel required.

Like all steel castings thus made, the grain is coarse, the strength relatively low, requiring working to reduce grain size for obtaining strength. Working methods include hammer forging; press forging; drop forging; rolling to square, sheet or round; piercing; drawing and so on.

The manner of working controls strength to certain measure; small piano wire, for example, drawn and drawn again many times, heating between draws, secures its great strength by a certain elongation of grain structure—piano wire showing greater strength than any other form of the same steel. Seamless drill pipe is made by several processes, as: piercing as in the Mannesman process; piercing while rolling, as in the Diescher mill. As drill pipe is subjected to both torsion and tension while drilling, any process that increases torsional strength without impairing tensile strength makes better, safer drill pipe.

Steel Castings

As poured from the furnace, steel castings are coarse grained, relatively brittle, requiring further treatment to make them usable. Many are simply annealed—heated and cooled slowly—but steel castings yield to heat treatment to the same relative measure as parts made of wrought steel, where the shape permits quenching. It is the part of the designing engineer to furnish shape, where possible, which will permit heat treatment of parts where strength is desired, together with safety against distress.

Castings of steel may be quenched once although a double quench and a final temper furnishes safer steel.

Physical Properties Chart

A single physical properties chart is included in this article, but there is no mystery about it, and a close examination reveals all that may be desired in the way of information on steel. Take that showing the physical properties of SAE 4650. As quenched, the steel is entirely too brittle for service accompanied by shock, so it is tempered, and the first temper is shown at 800° F. For some uses, the Izod impact value is sufficiently high, as for example in gears not subjected to much shock, for at this 800°F. temper, the gear tooth faces show a Brinell hardness of 388. As the tempering increases, the tensile strength and elastic go down, but the impact value rises, so that at 1000° F. draw, the Izod impact value has increased to 40, but this steel, peculiarly one of its most valuable properties, still has a Brinell hardness of 330, and thereby, shock resistance is imparted while the hardness is relatively high for resistance to abrasion.

Not all steels listed by the Society of Automotive Engineers are commercial steels, for many of them are made only on especial order. There are others however, that are made in large quantities, as: 3140, 4140, 6150. I take a stock list of steels carried by a steel company representative in Houston. The steels carried in stock at Houston are: 1015 to 1055, carbon steels; 2315 to 2345, nickel steels; 3115 to 3145, chrome nickel steels; 4140, chrome moly; 4614 nickel moly; 6140 to 6150, chrome vanadium steels. This array covers a range of steel for all purposes, and the sizes carried run from ½-inch to 10-inch in diameter.

Nickel-Bearing Alloys

IN THE PRODUCTION AND DRILLING OF PETROLEUM

By B. B. MORTON,
Development and Research Division,
International Nickel Company, Inc.

THE chief characteristic of nickel-bearing steels is toughness; that is, the possession of good physical properties coupled with the ability to absorb considerable energy in the form of shock. This property has resulted in the wide acceptance of these steels in the equipment used during drilling and production of petroleum. Table 1 outlines some of the uses of nickel-bearing steels in drilling equipment as well as the major stresses encountered by the part. This table will be found of value in specifying materials for a given use.

Drilling

The nickel-chromium steels, S. A. E. 3140 and and X-3140, play a spectacular role in rotary drilling operations as drill collars and kellys. Figure 1 shows a drill collar of S. A. E. X-3140 which is 10½ inches O.D. x 3½ inch bore x 40 feet long and which weighs 10,270 pounds finished. The insert of Figure 1 gives some idea of the accuracy and straightness of the bore and typical properties of specimens cut from the body of a normalized and drawn drill collar of S. A. E. X-3140, 4½ inches in diameter, are reported in Table 2.

The values given in Table 2 are representative of the body. The ends of these collars are oil quenched and drawn to give a higher hardness in the threaded portion. The Brinell hardness of the ends will range from about 275 to 285 BHN.

The selection of S. A. E. X-3140 for drill collar service appears to be based on good machining properties; high strength after simple heat treatment and good endurance limit, i. e., good resistance to repeated (fatiguing) stresses.

Parts of drilling equipment especially subject to static and alternating stresses and to sudden shock are the crown and traveling

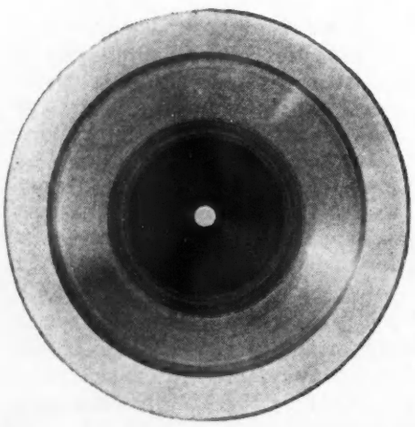


FIGURE 1
Drill Collar of S.A.E. X-3140 10½" O.D. x 3½" Bore x 40 ft. long.
Courtesy Baash-Ross Tool Company

TABLE 1

Summary of General Requirements and Nickel Alloy Steels Used in Rotary Drilling Equipment*

PARTS	GENERAL REQUIREMENTS: High Yield Strength in: Tension	Bending	Compression	Torsion	Shear	Resistance to: Fatigue	Shock	Wear	Galling or Seizing of Threaded Portions	Corrosion Fatigue	Depth of Hardening	STEELS
Drilling Tools and Accessories:												
Bit bodies	..	..	..	..	x	x	x	..	x	..	..	Cast nickel-chromium and nickel-molybdenum steel
Bit and reamer cutters	..	..	..	..	..	..	x	x	....	..	..	SAE 3115, 4615, 2315
Cutter pins	..	..	x	..	x	..	..	x	....	..	..	Carburized SAE 3115, 4615 and 2315
												Also oil-hardened SAE 3250, 4650, 3340
Reamer bodies	..	..	..	x	..	x	..	..	x	..	x	SAE X-3140; also SAE 3140
												Cast nickel alloy steel sometimes used
Drill collars	x	x	..	x	..	x	..	..	x	..	x	SAE X-3140; also SAE 3140
Kellys	x	x	..	x	..	x	..	..	x	..	x	SAE X-3140; also SAE 3140
Tool Joints	x	..	..	x	x	x	..	..	x	x	x	SAE X-3140; also SAE 3140
Fishing taps and dies	x	..	x	..	x	..	..	x	....	..	..	Carburized SAE 3115, 4615, 2315
Slips	x	..	x	..	x	..	x	x	....	..	..	Carburized SAE 3115, 4615, 2315
Rotary Chain:												
Side bars	x	..	..	..	..	x	x	x	....	..	..	SAE 3135, 3140
Connecting pins	..	x	x	x	x	x	x	x	....	..	..	Carburized SAE 2512
												Oil-hardened SAE 3245
Bushings	..	..	x	..	..	x	x	x	....	..	..	Carburized SAE 2320
Draw Works:												
Shafting	..	x	..	x	x	x	x	..	....	..	x	SAE X-3140, 3245, 3140
Brake Rims	x	..	..	..	..	..	..	x	x	..	..	Cast nickel alloy steel
Brake Bands	x	..	..	..	..	..	..	..	....	..	..	High carbon nickel-molybdenum steel
Sprockets	x	..	..	..	x	x	x	x	....	..	..	Cast nickel alloy steels
Rotary Machines:												
Shafting	..	x	..	x	..	x	..	..	....	..	x	SAE X-3140, 3245
Gears	..	..	x	..	x	x	x	x	....	..	..	Carburized SAE 2315, 2512
												Oil-hardened SAE 3245
Crown and Traveling Blocks:												
Bearings	..	..	x	..	..	x	x	x	....	..	..	Carburized SAE 3115, 4615
Pins	..	x	x	..	..	x	x	x	....	..	..	Carburized SAE 4615, 3130
Sheaves	..	x	x	..	..	x	x	x	....	..	..	Cast nickel alloy steel
Rotary Swivels:												
Bearings	..	..	x	..	..	x	x	x	....	..	..	Carburized "Krupp analysis"
Bail Bolts	x	..	..	..	..	..	x	..	....	..	..	SAE 3245
Slush Pumps:												
Piston rods	..	x	..	..	..	x	x	x	x	..	..	SAE 3140, 3150, 2325
												Carburized SAE 4615
Valve bodies and seats	..	..	x	..	x	x	x	x	....	..	..	Carburized SAE 4615, 3115
Cylinder liners	..	..	..	..	..	..	..	x	....	..	..	Carburized SAE 4615
Well-control Equipment:												
Blow-out preventers	x	..	..	..	..	..	x	..	....	..	..	Cast nickel alloy steels
												Forged SAE 3140
Drilling valves	x	..	..	..	..	..	x	..	....	..	..	Cast nickel alloy steels
												Forged SAE 3140
Control valves	x	..	..	..	..	..	x	..	....	..	..	Cast nickel alloy steels
												Forged SAE 3140
Bolts and studs	x	..	..	..	x	..	x	..	....	..	..	SAE 3140, 3240, 2330

*Adapted from a paper presented by A. G. Zima, (The International Nickel Co., Inc.) before the American Petroleum Institute at Tulsa Okla., May, 1936.

TABLE 2

Properties of S.A.E. Steel X-3140 Drill Collar

Diameter	4½"
Heat Treatment	Normalized and drawn
Tensile Strength	105,000 p. s. i.
Yield Point	80,000 p. s. i.
Elongation (2")	21.5 percent
Reduction of Area	46.2 percent
Brinell Hardness	212

TABLE 3

Cast Brake Rim Steel

Carbon	0.20—0.30 (0.20 preferred)
Nickel	1.75—2.00
Molybdenum	0.30—0.35
Manganese	0.55—0.75
Silicon	0.20—0.35

Heat Treatment

Heat to 1725°F.; hold two hours and air cool. Re-heat to 1200°F.; hold two hours; air cool.

(**Note:** A coarse structure appears desirable and should result from this treatment.)

The following physical properties may be expected:

Ultimate Strength	90,000—100,000 p.s.i.
Yield Point	60,000— 70,000 p.s.i.
Elongation in 2"	25—20 percent
Reduction of Area	40—35 percent
Charpy Impact	40—35 ft. lbs.

blocks, as well as the rotary swivel bearings. The pins of the blocks are made of carburized S. A. E. 3115, 4615 and 2315, or where oil hardening steels are preferred for such parts, S. A. E. 3250 is used. As bearings in swivels, carburized "Krupp Analysis" (approximately 0.12 carbon, 4.10 nickel, 1.10 chromium) is used.

The liners of slush pumps are called upon to withstand the abrasive action of the mud pumped. For this service, carburized tubing of S. A. E. 4615 is widely used; however, heat-treated cast-iron liners are invading this field. These irons are usually alloys of nickel-chromium or nickel-chromium-molybdenum of a general analysis as: 3.20 total carbon, 1.60 nickel, 0.60 chromium, 0.40 molybdenum.

A suitable material for brake rims has been the subject of much study and experiment. At the present time an analysis of a nickel-molybdenum steel shown in Table 3 appears to offer good possibilities for water or air cooled rims.

One of the most highly stressed members in the rotary drill string is the tool joint. The requirements for tool joints have been outlined by R. Lowrey[1] as follows: "It is essential that these parts possess toughness, torsional strength, high resistance to fa-

[1]"High Strength and Toughness in Oil Well Tool Joints," R. Lowrey, Met. Hydril Co. in Nickel Steel Topics, Oct., 1935, Vol 4, No. 5.

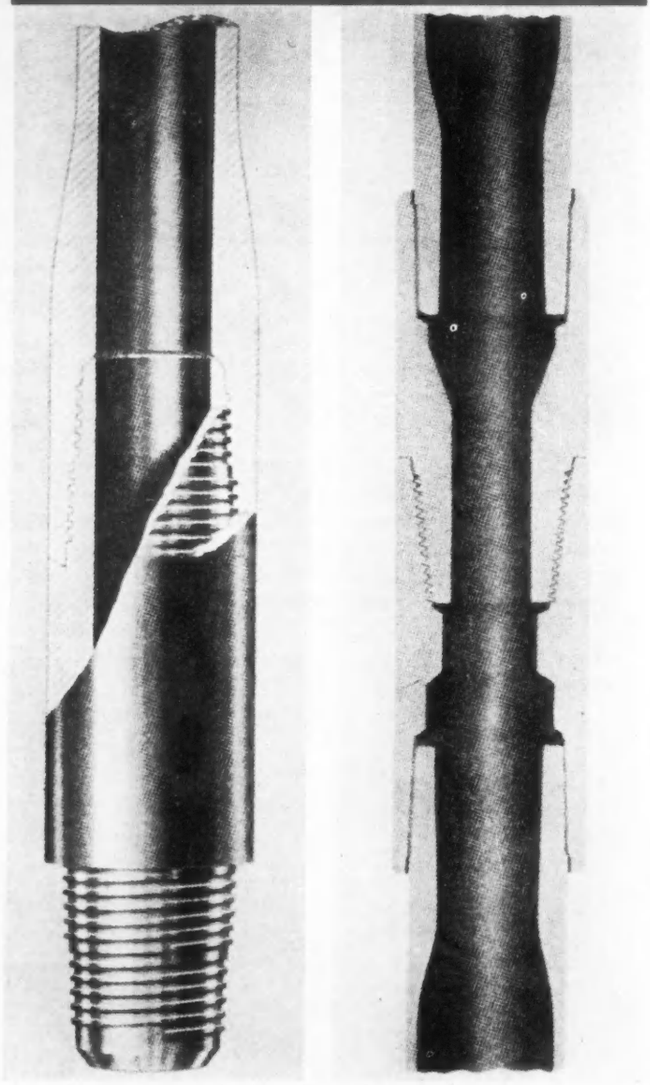


FIGURE 2

SAE X-3140 Steel "Internal Flush" Tool Joint (Courtesy of Hydril Company.)

Standard A.P.I. Type Tool Joint of S.A.E. 3140 Steel. (Courtesy of Reed Roller Bit Company.)

tigue, and, in addition, sufficient hardness in the threaded portion to prevent galling." For this trying service, S. A. E. 3140 and S. A. E. X-3140 are widely used. Figure 2 shows two types of joints in common service. A careful study of the subject of "seizing" or "galling" of the threads of tool joints reveals that the nature of the finish controls the tendency to seize or gall. A careful finish of threads, resulting in complete removal of burrs and small imperfections, will greatly minimize this evil, and during heat treatment, decarburization must also be avoided if this trouble is to be eliminated.

Nickel-bearing steels find wide application in the draw works; and rotary machines especially in the gears and shafts.

Cast nickel and nickel-chromium steels are largely used as the body of bits and reamers. Also, for highly stressed parts, as sprockets, gears, drum heads and spools. The fact that these steels can be readily produced with minimum physical properties of tensile strength 100,000 p.s.i., yield point 60,000 p.s.i., and 18 percent elongation in 2 inches, coupled with the economies to be gained by using cast parts, is rapidly increasing their use.

Production

The satisfactory production from flowing or pumping wells is largely dependent upon the correct selection of materials, since there are factors of both corrosion and abrasion to be considered.

In the case of flowing wells, it is common to find the valves used in the "Christmas Tree" assembly made from nickel alloy steels. Figure 3 shows a cast nickel-chromium steel "Tubing Head."

In pumping wells, large reversals of stress occur which put a demand upon polished and sucker rod materials that they possess a high endurance limit. Since corrosion, especially by hydrogen sulfide, can markedly affect the endurance limit, it becomes also necessary that the materials resist the action of this gas. Monel* has made an outstanding showing as a polished rod in the very corrosive fields of West Texas, also in the West Kansas fields and the Michigan fields. The physical properties of cold rolled monel are shown in Table 4; these properties, combined with the excellent resistance to the corrosive conditions encountered, serve to explain the good showing made by this alloy as a polished rod material.

TABLE 4

Typical Physical Properties Cold Rolled Monel

Ultimate Strength	85—125,000 p.s.i.
Yield Point	60— 95,000 p.s.i.
Elongation (2")	35—15 percent
Brinnel Hardness	160—220
Endurance Limit (air)	50— 55,000 p.s.i.

Monel jacketed polished rods, consisting of a monel tube drawn over a rod of S. A. E. 4615 to standard O.D. sizes, are being presented to the industry and may result in some economies over using solid monel rods.

Monel is finding wide application as the material for drops and seats of valves in corrosive fields. It is also used as important parts of gas lift equipment.

Inconel (approximately 80 percent nickel, 14 per-

*Approximately 69% nickel, 29% copper.

TABLE 5

Analyses of Widely Used Sucker Rod Materials for Corrosive (H_2S plus Water) Wells

	C	Mn	P	S	Si	Ni	Mo	Slag
Nickel-iron	0.05	0.04	0.08	0.02	0.16	2.50	....	3.00
Nickel-molybdenum-iron	0.07	0.18	0.018	0.025	0.020	2.75-3.25	0.15-0.30	....
S. A. E. 4615	0.12-0.18	0.30-0.60	0.04	0.05	0.15-0.30	1.50-2.00	0.20-0.30	....

Courtesy J. B. Beaird Company.

FIGURE 3

Casing Head (Cast nickel-chromium steel).

cent chromium, 6 percent iron) has received very favorable reports as the "Traveling Tube," which is part of well known, deep well pumps. The most spectacular performance of an Inconel traveling tube is reported from a well in Harris County, Texas, where it had given a life of 13 months compared with 2½ months for a steel tube, and the Inconel tube was still in service when the report was made.

The most suitable material for sucker rods has received considerable attention and study. The results appear to date to indicate for intensively corrosive wells where stress is not a prominent factor a nickel or nickel-molybdenum iron, and for wells where both corrosive conditions and stresses exist, the nickel-molybdenum steel S. A. E. 4615. Table 5 gives the analyses of some nickel-bearing sucker rods widely used.

The high order of resistance to oil well corrosion shown by pure nickel when tested as the material for well strainers has made it outstanding for this service. The recent advances in price of crudes should bring the matter of strainers back into importance as old wells are re-worked.

Monel is associated with the metering of oil and gas in a number of locations. Monel orifices are well known and widely used. Figure 4 shows a meter of a well known type that uses monel interior working parts such as valves, valve seats and piston guide rods. Especially in connection with West Texas crudes are monel parts of meters, reducing valves and control valves used. This alloy possesses a very high order of resistance to cold hydrogen sulfide and to condensed vapors containing both hydrogen sulfide and hydrochloric acid.

The increasing demand on the production end of the oil industry and its improving economic position both tend to introduce alloys to wider uses. The nickel-bearing alloys, by virtue of good physical properties and often of good resistance to corrosive conditions, are rapidly being applied to new uses.

FIGURE 4

Bassler Liquid Meter (Monel interior working parts).

Courtesy American Liquid Meter Company.

Use of Molybdenum In Oil Fields

By JOHN E. WILSON,
Climax Molybdenum Company,
Los Angeles, California

THE oil industry during recent years has turned more than ever to alloys to provide the necessary improvement in the steel and cast iron used in drilling and production equipment. As longer drill strings have been employed, greater loads have been placed upon the operating equipment, and upon the drill string itself. With the increase in well depth, drilling time has also become an important factor, and increases in speed are necessary to operate economically. The drill string, which may be compared to a one to two-mile column partly under compression and partly under tension, has, therefore, not only been forced to withstand increases in tension and fatigue stresses, but has also had to withstand increases in torsional stresses. Likewise, the rotary and draw works were required to withstand increases in load and speed, necessitating increased strength and wear resistance in the surface equipment. Higher pressures were also required to pump the mud to greater depths, resulting in a need for an improvement in the slush pumps to withstand the greater stresses.

In order to obtain the necessary improvement in yield strength, fatigue strength, shock resistance, and wear resistance of steel, a great deal of attention was given to the nature of the material that was used. Attempts were first made to meet those conditions requiring increased strength by varying the carbon content, and by changing the heat-treatment. However, it was soon discovered that such an approach had very definite limitations. In many cases it was found that the improvement in strength was insufficient, and in all cases it was noticed that the increase in strength was obtained only at the expense of the toughness and ductility of the steel. In an industry which required not only an improvement in the tensile strength and yield strength, but also in the ductility and toughness, carbon steels soon proved to be inadequate for severely stressed parts. Likewise, unalloyed cast iron parts subjected to increased stresses were unable to keep pace with the needs of the industry. As a result, alloys have been employed to obtain a combined improvement in the physical properties of both cast iron and steel.

Corrosion is a problem which has always confronted the oil producer to a greater or lesser degree. In many cases, such as surface coverings exposed to the atmosphere, and subsurface parts operating in a corrosive media (such as brine or hydrogen sulphide), alloys have been used to advantage.

Steel

Molybdenum, as an alloying element in the iron-carbon system, is soluble in α and δ iron, and forms the carbide, Mo_2C. The critical points are raised slightly on heating, and lowered markedly on cooling by molybdenum additions. The sluggishness which this element also imparts to structural changes accompanying heat-treatment, permits the use of less drastic quenching mediums and higher drawing temperatures. It is also responsible for the grain refinement and depth-hardness that is characteristic of molybdenum steels.

The effect of molybdenum additions to steel is reflected in a marked increase in the ultimate and yield strength, without a corresponding loss in elongation and reduction in area, as shown in Table 1.

TABLE 1

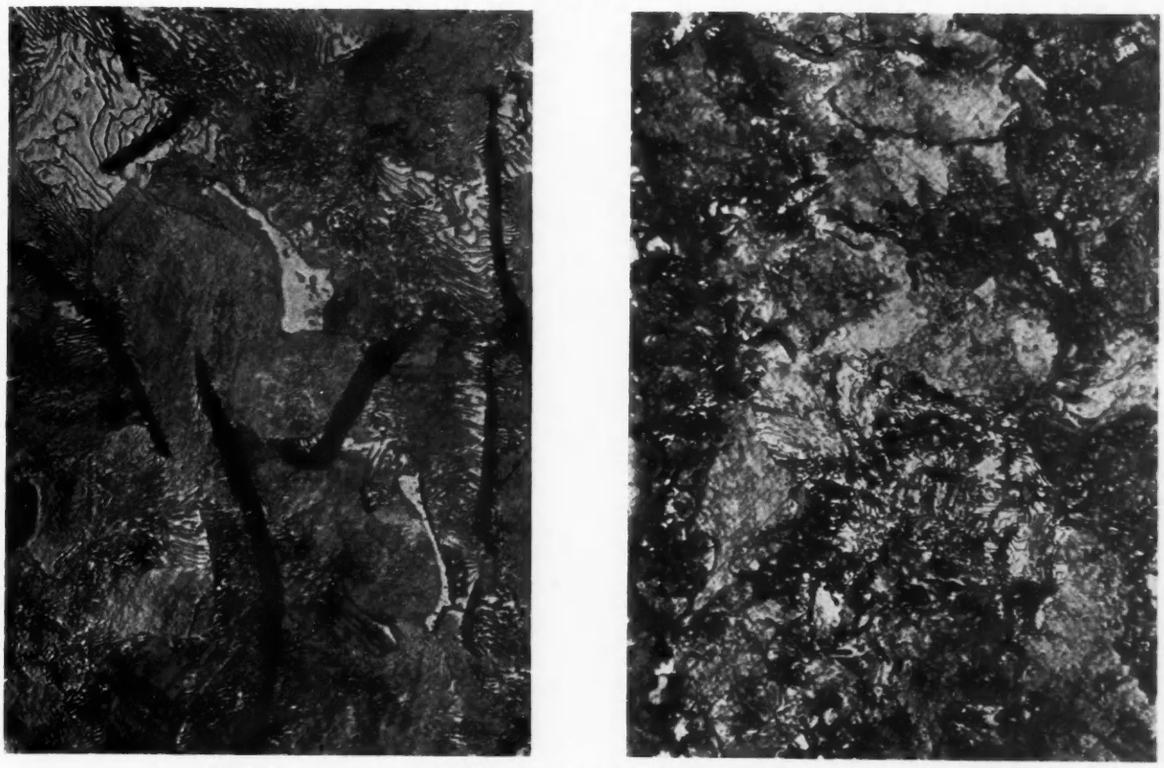
	Carbon (Percent)	Manganese (Percent)	Silicon (Percent)	Molybdenum (Percent)
Carbon Steel (S.A.E. 1040)	.35–.45	.60–.90	.15–.30	.....
Carbon-Molybdenum Steel	.35–.45	.60–.80	.15–.25	.30–.40

	Heat Treatment		Physical Properties			
	Water Quench. (Deg. F.)	Draw (Deg. F.)	Tensile Strength (Lbs. per Sq. In.)	Yield Strength (Lbs. per Sq. In.)	Reduction of Area (Percent)	Elongation in 2 In. (Percent)
S.A.E. 1040	1450	1050	110,600	75,000	56.0	21
Carbon-Molybdenum Steel	1550	1050	151,000	131,000	57.5	16

The effect of molybdenum additions to chromium, nickel, and chromium-nickel steels is, briefly, to enhance the properties of those steels. To illustrate, the effect obtained by the addition of .27 percent molybdenum to a chromium steel is shown in Table 2.

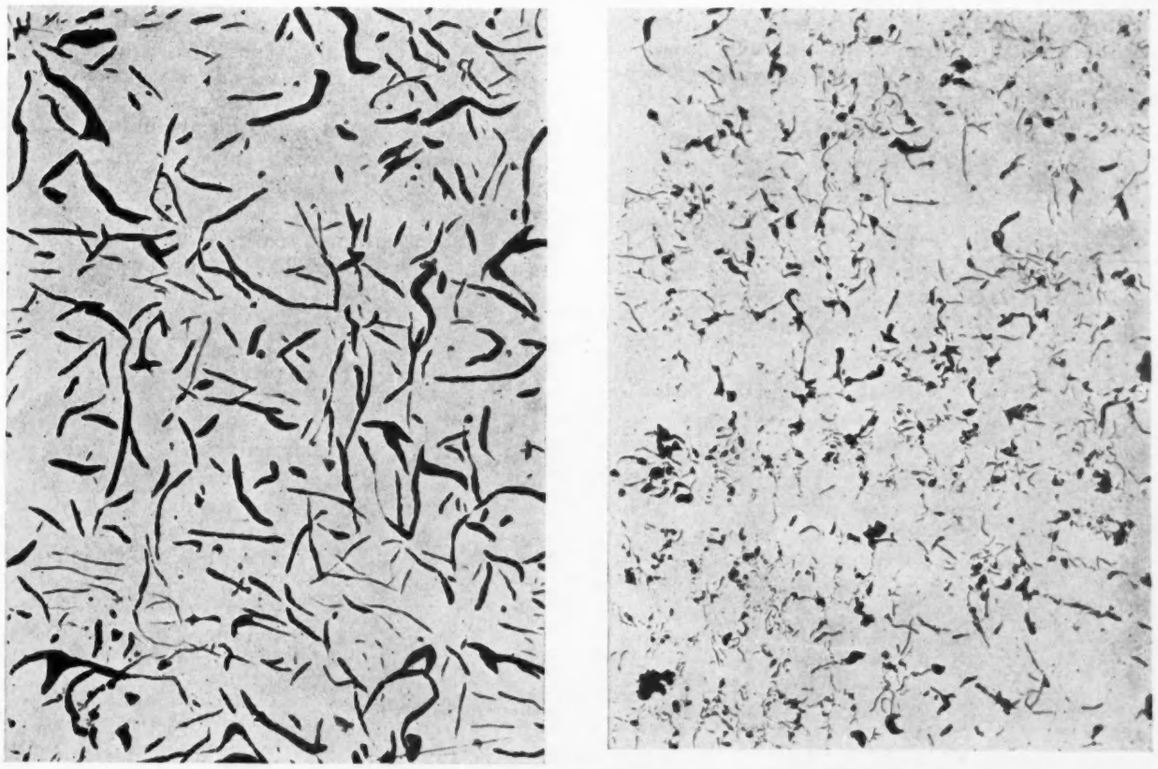
As in steel, Molybdenum com-

FIGURE 1



Plain Iron (X500, Eached in 2% Nital) Molybdenum Iron

FIGURE 2



Plain Iron (X100, Unetched) Molybdenum Iron

bines with α and δ iron, and also forms the carbide, Mo_2C in cast iron. It exerts a refining action on the matrix, as shown in Figure 1, and nodulizes the graphitic flakes, as shown in Figure 2.

The effect of molybdenum on the properties of cast iron is characterized by a marked improvement in the tensile strength, transverse strength, deflection, resilience, and wear resistance.

Molybdenum added to a chromium, nickel, or a chromium-nickel iron, results in an improvement in physical properties of those irons.

TABLE 2

	Carbon (Percent)	Manganese (Percent)	Chromium (Percent)	Molybdenum (Percent)
Chromium Steel	0.33	0.41	0.72	....
Chromium-Molybdenum Steel	0.32	0.72	0.80	0.27

	Heat Treatment		Physical Properties				
	Water Quench. (Deg. F.)	Draw (Deg. F.)	Tensile Strength (Lbs. per Sq. In.)	Yield Strength (Lbs. per Sq. In.)	Elongation in 2 In. (Percent)	Reduction of Area (Percent)	Izod Impact (Foot-Lbs.)
Chromium Steel	1,550	1,020	115,450	93,530	20.6	61.2	78.0
Chromium-Molybdenum Steel	1,550	1,130	141,900	122,200	19.8	65.2	76.0

(After J. M. Camp and C. B. Francis, "The Making, Shaping & Treating of Steel," published by Carnegie Steel Co. (1925.)

Drilling Equipment

The improvement in physical properties obtainable with molybdenum steels, together with their relatively low cost, made them desirable to meet the severe conditions to which oil drilling equipment is subjected. The modern tool bits, acting as a cutting agent, and as a point of support for a 10,000-foot rotating flexing column, are subjected to high stresses. In the shallower wells it was feasible to make repairs or replacements often without seriously impairing the drilling rate; but in the deeper wells the time required to repair the bits has become an important factor and, as a consequence, advances in metallurgy and drilling technique have been made in an effort to keep the tools in a working condition at the bottom for longer periods of time.

Bits and Reamers

It is the customary practice to hard-face the cutting edges of the fish tail and drag bits. However, the high temperatures that are attained during the welding operations are conducive to grain growth which, if not obliterated by a subsequent heat-treatment, would seriously impair the impact properties of the steel. Some producers have inhibited the grain growth that takes place during welding by adopting a carbon-molybdenum cast steel for their drag bits of approximately the following analysis:

Carbon (Percent)	Manganese (Percent)	Molybdenum (Percent)
.28–.30	.60–.80	.15–.30

A heat-treated drag bit of approximately the following analysis has been adopted by some companies for severe service requirements:

Carbon (Percent)	Manganese (Percent)	Chromium (Percent)	Nickel (Percent)	Molybdenum (Percent)
.25–.35	.50–.80	.50–.80	1.50–2.00	.20–.40

A forged silicon-molybdenum steel has been used by some for fish tail bits because of the improved welding characteristics, high physical properties, and ease of heat-treatment. The approximate chemical analysis is as follows:

Carbon (Percent)	Silicon (Percent)	Molybdenum (Percent)
.30–.40	.80–1.10	.30–.40

Molybdenum steels play an important part in the modern rock bits and reamers which are being used today. Essentially, they consist of a body, cutters, and pins, or bearings assembled into a composite tool capable of withstanding severe abrasive, compressive, and torsional stresses imparted during drilling.

The cutters are usually made from S.A.E. 4615 or S.A.E. 4815. (See Figure 3.)

The pins or bearings must of necessity present a high surface hardness. In those cases in which the pins are subjected to high loads requiring a combination of hard-wearing surface, together with high pin sheering strength, an analysis similar to S. A. E. 4650 is employed.

In those cases in which slightly higher core hardness coupled with core toughness is demanded, carburized S. A. E. 4615 steels are employed.

Various analyses have been used for the bit and reamer bodies, some of which are shown in Table 3 and Table 4.

TABLE 3

Rock and Core Bit Bodies

	Carbon (Percent)	Nickel (Percent)	Manganese (Percent)	Chromium (Percent)	Molybdenum (Percent)
1. Carbon-Molybdenum Cast Steel.	0.28–0.30	.....	0.60–0.80	.....	0.15–0.30
2. Nickel-Molybdenum Cast Steel.	0.25–0.30	1.00–1.50	0.60–0.80	.....	0.25–0.30
3. Chromium-Molybdenum Cast Steel	0.35–0.45	.....	0.60–0.90	0.80–1.10	0.15–0.25

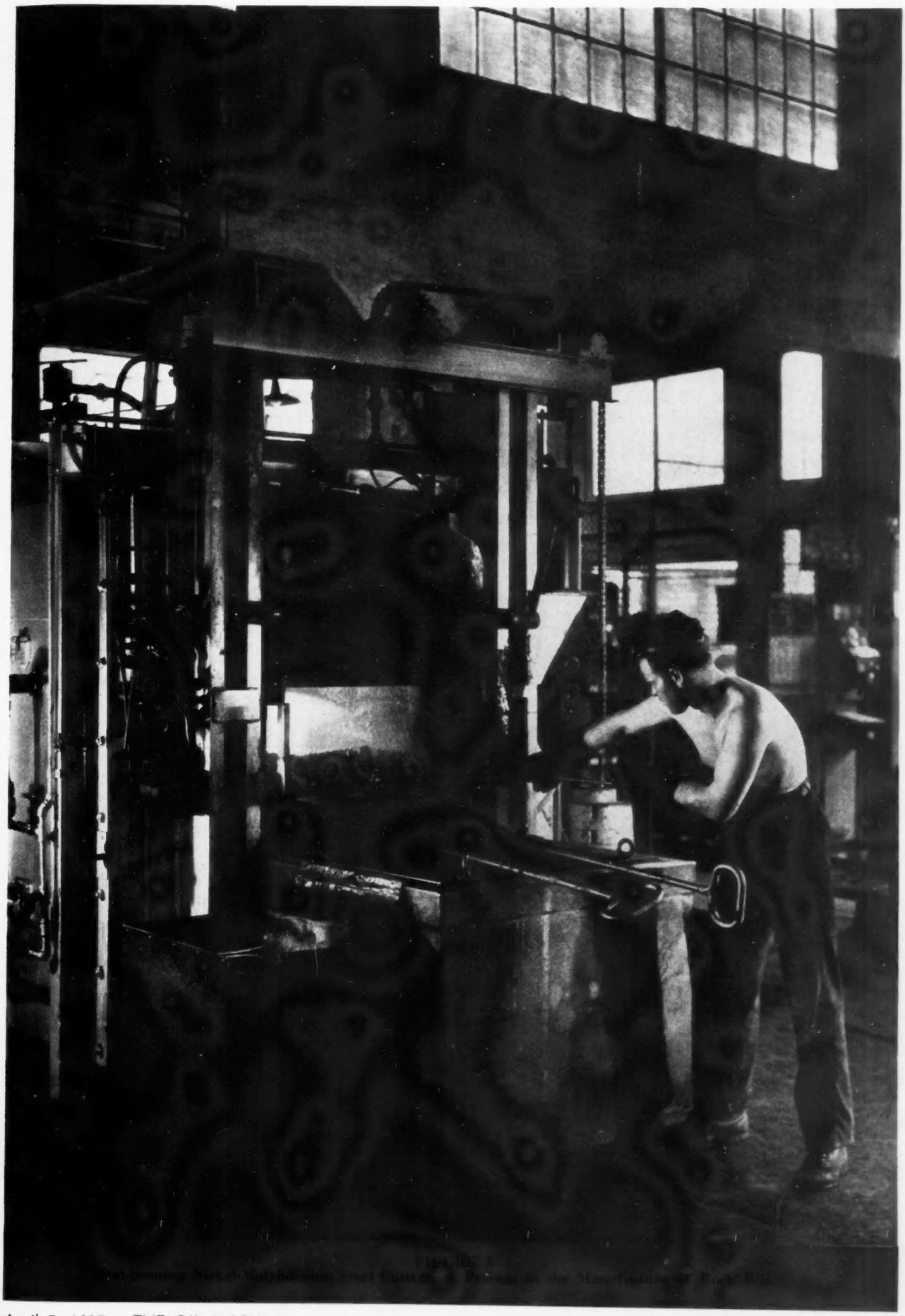
TABLE 4

Reamer Bodies

	Carbon (Percent)	Nickel (Percent)	Manganese (Percent)	Chromium (Percent)	Molybdenum (Percent)
1. Forged Chromium-Molybdenum Steel	0.35–0.45	.....	0.60–0.90	0.80–1.10	0.15–0.25
2. Cast Chromium-Nickel-Molybdenum Steel	0.30–0.40	1.00–1.50	0.50–0.80	0.45–0.75	0.25–0.35

Drill Pipe, Tool Joints, Drill Collars, Substitutes and Kelly Bars

The increased length and resultant load have served to increase the stresses set up in the drill strings during operation. Constant improvement in the selection and heat-treatment of the material has



done much to reduce the failures in drill pipe due to transverse fractures in the body and last fully engaged thread. An improvement in the physical properties of plain carbon steel can be obtained by heat-treatment, but the quenching of a 40-foot drill pipe is rife with many difficulties. If proper care is not observed, incipient cracks may result and pave the way for early failures. In order to avoid this danger one manufacturer has adopted a normalized and drawn manganese-molybdenum steel pipe of approximately the following analysis:

Carbon (Percent)	Manganese (Percent)	Silicon (Percent)	Phosphorus (Percent)	Sulphur (Percent)	Molybdenum (Percent)
.45	1.50	.25 Max.	.04 Max.	.04 Max.	.20

This analysis is capable of producing physical properties in excess of the A.P.I. Grade "D" specification.

Alloy steels have long been used to provide the necessary fatigue, yield, and impact strength required to offset the notch effect and reduction in area at the threaded section of the tool joints, substitutes, drill collars, and kellys. S.A.E. 4140 is used for these parts, with a slight modification of the heat-treatment to meet specific applications. The kellys and drill collars are usually placed in service after normalizing and drawing, the ends being oil quenched and drawn to provide sufficient hardness in the threaded sections. The tool joints and substitutes are oil quenched and drawn to a Brinell hardness of approximately 285-321.

Sucker Rods, Sucker Rod Couplings and Polished Rods

A great deal of attention has been given to the proper selection of material for use in the manufacture of sucker rods. In the deeper non-corrosive wells in which heavy loads are encountered, it was soon noticed that fatigue and distortion reduced the life of carbon steel rods markedly. In order to obtain an increase in the endurance limit and the yield strength without a reduction in the ductility or toughness, a heat-treated chromium-molybdenum sucker rod has been employed by one manufacturer. The physical properties of S.A.E. 4130 steel compared with S.A.E. 1050 steel are shown in Table 5.

A polished rod made from S.A.E. 4130 is also used in wells in which the operating stresses are extremely high.

There has been a great deal written in an attempt to explain the causes for the early failure of sucker rods in corrosive wells, especially those containing objectionable percentages of hydrogen sulphide. It has been shown that a steel possessing a relative high fatigue limit and low corrosion resistance will, when subjected to alternating stresses in a corrosive medium, show up poorly in comparison with one having a lower fatigue strength. However, in the heavier pumping wells in which the more corrosion-resistant low metalloid rods were introduced, rod failure was pronounced. This was traced to the low yield strength of these types of steel.

An improvement in the yield strength, without a reduction in the corrosion fatigue properties, has been obtained by using a nickel-molybdenum sucker rod. At the present writing three general types of nickel-molybdenum steels have been adopted, of which possibly the most widely used is S.A.E. 4615/20.

The physical properties of S.A.E. 4615 after normalizing are shown in Table 6.

The following service results were reported:[1] "Company 'G,' Carter lease, Seminole, Oklahoma, installed in a 4400-foot well, S.A.E. 4615 rods, which ran 11 consecutive months without a break. During the same period 22 breaks occurred in other types of steel rods of reputable manufacture, which were installed alternately with the S.A.E. 4615 rods. Company 'G' now has more than 400,000 feet of S.A.E. 4615 sucker rods in service, and claims a definite improvement over all other grades of steel.

"Company 'S,' Beetles lease, Eldorado, Kansas, using S.A.E. 4615 steel in a 3500-foot well, ran 120 days without a break. The economic life of the string was 13 months, whereas with other types of steel the maximum economic life of a string experienced by this company was 4 months."

A higher nickel, lower carbon, nickel-molybdenum sucker rod is being employed in the more corrosive wells. The approximate analysis of this type of rod is as follows:

Carbon (Percent)	Manganese (Percent)	Phosphorus (Percent)	Sulphur (Percent)	Silicon (Percent)	Nickel (Percent)	Molybdenum (Percent)
.07 Max.	.18	.018	.025	.02	2.75–3.25	.15–.30

In very corrosive, heavy pumping wells there is some tendency to adopt a sucker rod made from S.A.E. 4815. S.A.E. 4615, case carburized, is generally employed for sucker rod couplings, and with the proper precautions used in making up the strings, little trouble has been encountered in the couplings.

[1] Correspondence with D. M. Hammett, Axelson Manufacturing Co., Tulsa, Okla., Oct. 8, 1936.

TABLE 5

	Chemical Composition				Heat Treatment	
	Percent	Percent	Percent	Percent	Percent	Percent
S.A.E. 4130	C—.30	Mn—.65	Cr—.65	Mo—.20	Normalized, Quenched & Drawn	
S.A.E. 1050	C—.50	Mn—.65	.....	.....	Normalized, Quenched & Drawn	
	Yield Strength P.S.I.	Ultimate Strength P.S.I.	Elongation in 2"—%	Reduction of Area %	Izod Impact Ft.-Lbs.	Endurance Limit P.S.I.
S.A.E. 4130	95,000	125,000	30	65	85	70,000
S.A.E. 1050	85,000	115,000	23	55	35	59,000*

* Bull. No. 128-A (1135) on Sucker Rods, p. 4, published by Oil Well Supply Co.

TABLE 6

Chemical Composition		Physical Properties					
	Percent	Yield Point P.S.I.	Tensile Strength P.S.I.	Elongation in 2"—%	Reduction of Area %	B.H.N.	Charpy Impact Ft.-Lbs.
Carbon	.12– .18	45,000 to 55,000	80,000 to 90,000	28	55	170	33
Manganese	.30– .60						
Phosphorus	.04						
Sulphur	.05						
Silicon	.15– .30						
Nickel	1.50–2.00						
Molybdenum	.20– .30						

Deep Well Pumps

A number of factors govern the selection of deep well pump liners, viz., the conditions existing in the well (degree of abrasion encoun-

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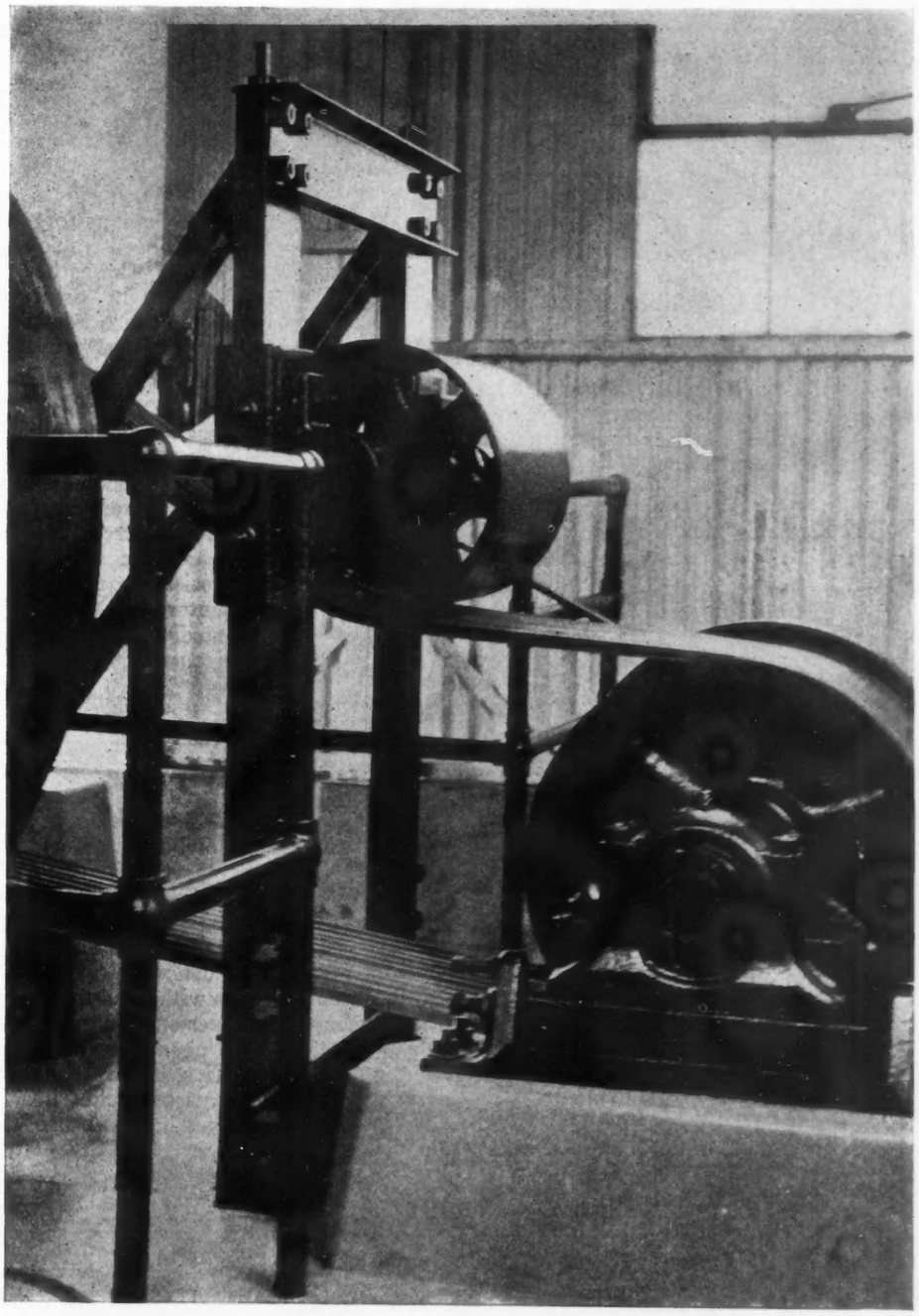

Dodge-Timken Pillow Blocks with Adjustable Base Plates on geared pumping power.

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TABLE 7

	Carbon (Percent)	Silicon (Percent)	Nickel (Percent)	Manganese (Percent)	Chromium (Percent)	Molybdenum (Percent)
Molybdenum cast iron. A. Stress-relieved. B. Oil-quenched at 1,500–1,550 deg. F., and drawn to desired hardness.	3.10–3.30	2.00–2.20	.....	.....	.....	0.35–0.50
Nickel-Molybdenum cast iron. (Heat-treated as B above.)	3.10–3.40	1.80–2.00	1.00–1.10	.60– .80	.....	0.30–0.40
Chromium-Nickel-Molybdenum cast iron. A. Stress-relieved. B. Quenched at 1,500–1,550 deg. F., drawn to desired hardness.	3.10–3.30	2.00–2.20	0.50–0.70	.....	0.15–0.30	0.30–0.40
Nickel-Molybdenum steel. S.A.E. 4615, carburized and heat-treated.						

tered, etc.) and initial cost. Table 7 illustrates a few analyses that have given satisfactory service.

Slush Pumps

The high pressures encountered in deep well drilling, coupled with the abraiding action of sand and mud, have necessitated an increase in the strength and abrasion resistance of the pump parts.

Several types of liners have been adopted, three of which are shown below:

	Sample No. 1 (Percent)	Sample No. 2 (Percent)	Sample No. 3* (Percent)
Carbon	3.10–3.30	3.10–3.30	0.10–0.20
Manganese	.....	.....	0.40–0.70
Silicon	1.25–1.50	2.00–2.20	.....
Phosphorus	.....	.....	0.04 Max.
Sulphur	.....	.....	0.05 Max.
Nickel	0.75–1.25	.....	1.50–2.00
Molybdenum	0.50	0.35–0.50	0.20–0.30

* Carburized and heat-treated.

A number of steels have been employed for piston rods, depending upon the length, size, and nature of service. Three types which have been used satisfactorily are S.A.E. 4140, S.A.E. 4615, and S.A.E. 4815.

Valve bodies and seats are, in a number of instances, made from S.A.E. 4615, carburized steel. In some cases, heat-treated S.A.E. 4150 has also been used for valve seats.

A high tensile strength alloy cast iron has been employed to withstand the high pressures that are encountered, as well as the abrasive material that is continually passing through it. One such analysis that is used is as follows:

Carbon (Percent)	Silicon (Percent)	Manganese (Percent)	Nickel (Percent)	Sulphur (Percent)	Phosphorus (Percent)	Molybdenum (Percent)
3.00	1.10	1.00	2.00	.08	.12	.25

Drilling Valves, Flow Valves, Control Fittings, Blow-Out Preventers, Etc.

The pressures that are encountered in deep well drilling have necessitated equipment capable of withstanding increased pressures, as well as the ability to withstand sudden stresses.

Table 8 gives the comparative properties of cast carbon steel and Manganese-Molybdenum steel used in the production of valve bodies.

Cast, as well as forged valve bodies made from S.A.E. 4140 have been employed by some manufacturers.

S.A.E. 4041 has been adopted to a large extent as a bolting material, principally because of ease of machining in the heat-treated condition, and also because of its high physical properties.

Crown and Traveling Blocks

Because of the higher loads which are imposed in drilling deep wells, the crown and traveling blocks must of necessity be built more strongly. S.A.E. 4615, carburized, is used extensively for both the pins and the bearings where high surface hardness is required to withstand the wear, coupled with high core strength and resistance to shock, to withstand the sudden loads encountered in drilling. Castings similar to S.A.E. 4630, and medium Manganese-Molybdenum steel, have found favor as sheave material.

Actuating Equipment

The advances which have been made in the actuating equipment have necessarily centered about those parts that were highly stressed or subjected to excessive wear. In those parts there has been a noticeable application of molybdenum steel and cast iron.

Rotary chain links which must resist distortion are made from S.A.E. 4140. To withstand abrasion, high shear, and impact stresses, S.A.E. 4140 and 4615 (carburized) steels are used in the manufacture of pins and the bushings.

To withstand the torsional stresses and sudden impact stresses encountered, S.A.E. 4140 steel is being used for shafting material in drawworks. To overcome the heat checking which has been responsible for many early failures of brake rims, a steel similar to the following analysis has been used with satisfactory results:

Carbon (Percent)	Nickel (Percent)	Manganese (Percent)	Molybdenum (Percent)
.30 Max.	1.50–2.00	.55–.75	.35–.45

TABLE 8

	AS CAST		ANNEALED		NORMALIZED AND DRAWN		QUENCHED AND DRAWN	
	Carbon	Mn-Mo	Carbon	Mn-Mo	Carbon	Mn-Mo	Carbon	Mn-Mo
Tensile Strength, p.s.i.	75,000	105,500	76,400	92,600	73,650	94,950	80,000–125,000	90,000–187,000
Yield Point, p.s.i.	38,000	68,150	43,600	53,900	43,700	60,300	50,000– 97,000	65,000–179,000
Elongation in 2", Percent	22.5	11.0	26.	27.0	31.5	23.5	31.0–10.0	25.0–10.0
Reduction of Area, Percent	26.1	11.9	46.	45.8	62.0	52.8	65.0–18.0	58.9–25.0
Brinell Hardness Number	156	207	143	170	143	187	155 –250	183 –430
Izod Impact, Ft.-Lbs.	17.5	12.0	21.0	18.0	34.1	42.6	48.0–15.0	59 – 3
Charpy Impact, Ft.-Lbs.	12.8	17.5	16.5	17.8	23.4	33.3	30.0– 9.0	40 – 2
Endurance ratio	0.40	0.40	0.44	0.44	0.47	0.47	0.50	0.53

(After A. C. Gregg, "One Thousand Percent Increase in Valve Pressures," World Petroleum, 6 (7) 421 (1935).

Grain Structures and Properties of Metals and Alloys

By RUDOLPH SEIDEN, Consulting Engineer,
Kansas City, Missouri

EQUIPMENT failure has always been a large item in the production cost of oil. It was almost a prohibiting factor with the first well and today, after 75 years of continuous improvement in equipment and metals, *corrosion* costs the American petroleum industry over $135,000,000 annually. One to two percent of the iron equipment in use in the oil industry have to be renewed every year; and about 50 percent of the repair costs of the oil industry are caused by corrosion! Finally, we have to remember the losses of oil and the operating troubles in this connection.

Corrosion is a particularly difficult problem to combat since the conditions under which it occurs in the oil field and refinery can not be reproduced or even conveniently simulated in the metallurgical laboratory. For example chrome-steel alloy was thought not so long ago to be the refinery "cure-all"; it resists most of the common corrosives under laboratory conditions. Hot, acid, crude oil flowing at high velocity through pipes of this alloy, however, removes the passivating oxygen and quick failure results! The only reliable test of a new material therefore is by costly trial and error in actual use. One can name many metals and alloys that will withstand certain corrosive conditions, but *we should not select a material that will endure unless it has been tested under the conditions of practice.*

FIGURE 1
Workshop microscope.

A most important factor in the corrosion resistance of a metal is the *grain structure* of its constituents. Pit corrosion for instance is generally due to large grain size or segregation of impurities in the metal. An excess of silicon in cast iron will precipitate free *ferrite* (i.e. pure iron) and the galvanic action between ferrite and *graphite* (i.e. pure carbon, crystallized or amorphous) is in soil water much greater than between graphite and *pearlite* (i.e. a homogeneous and solidified mixture of a ferrite and iron carbide). *It is therefore quite as important for the petroleum engineer to know the grain structure of the material he purchases as well as its constituents and their properties.* The purpose of this article is to present the principles of metallography and metallurgy in a way that will enable the petroleum engineer to make a more intelligent purchase of equipment.

Qualitative Analysis Needed

In order to appraise a metal or alloy by its grain structure, one must have its *qualitative analysis* and the beginner should have at least a rough *quantitative analysis* of the material he is investigating. This is usually obtainable, as the metal used in high grade equipment of today has a "pedigree", so to speak, and quite often a "case history". If the analysis can not be obtained from the manufacturer it will have to

be determined in the laboratory before much can be said about the metal being investigated. It will be assumed here that the analysis is known.

Etching for Laboratory Study

In order to examine grain structure critically one must have a microscope and a number of abrasives and "etchants" for polishing and etching the specimens. Etching is employed to produce a relief effect of the crystals. Any good microscope may be used, but the stage must be fitted to supply direct light to the specimen surface; conventional microscopes are constructed for the examination of objects by transmitted light. Means should be provided for holding the plane of the specimen surface exactly perpendicular to the optical axis of the microscope.

It is most convenient to remove a small sample of material about ½ inch square. (If the material must be examined intact, a specially designed microscope will have to be used (see Figure 1). A face is ground on the specimen either with an emery wheel or file. This should be done with a very gentle pressure in order not to disturb the original grain structure with heat or stress. The sample is then further dressed on a polishing block covered with linen and a water-paste of No. 80 emery dust. The specimen is rubbed back and forth, always in the same direction, until the coarse marks disappear. It is then washed entirely free of the emery and transferred to a second block with flour-emery paste on a linen surface. The direction of rubbing is at right angles to the scratches of the first polishing. The sample is transferred subsequently to blocks covered with linen and tripoli powder paste, linen and jewelers rouge paste respectively, care being taken again to rub the specimen at right angles to the scratches of the previous polishing. This procedure is suitable for most alloys of iron.

TABLE 1

ETCHANT	PREPARATION	USED FOR
Nitric acid, alcohol solution	5 ml. HNO_3 95 ml. absolute alcohol	Outlining **ferrite** grain in cast iron, malleable iron, wrought iron (10 ml. HNO_3, 90 ml. alcohol), low alloy steels.
Picric acid, alcohol solution	5 gm. picric acid 95 ml. absolute alcohol	Same as nitric acid in alcohol, but better for special steels.
Concentrated nitric acid		Same as nitric acid in alcohol or picric acid in alcohol.
Stead's reagent	10 gm. $CuCl_2$ 40 gm. $MgCl_2$ 20 ml. HCl Enough hot water to make a saturated solution. Alcohol to make 1000 ml. solution	**Phosphorous** segregation in iron and steels. **Chrome-nickel** steels.
Sulfur printing solution	10 gm. $HgCl_2$ 20 ml. water 100 ml. conc. HCl	**Sulfur** in iron and steels.
Sodium picrate solution	2 gm. picric acid 24.5 gm. NaOH 73.5 ml. water	**Cementite** (i.e. **iron carbide**) in iron and steels.
Nitric acid, hydrochloric acid, glycerine solution	10 ml. HNO_3 20 ml. HCl 30 ml. $C_3H_5(OH)_3$	High **chromium** steels, chromium steels containing **aluminum, tungsten, vanadium, molybdenum.**
Hydrofluoric acid, nitric acid solution	2 ml. HF 25 ml. HNO_3 73 ml. water	**Aluminum**, aluminum alloys.
Ammonium persulfate, water solution	10 gm. $(NH_4)_2S_2O_8$ 90 ml. water	**Copper, brasses, bronzes.**
Glacial acetic acid, nitric acid, water solution	40 ml. $(C_2H_5O)_2O$ 50 ml. HNO_3 10 ml. water	**Nickel monel metal**, high nickel steels.
Chromic acid, sodium sulfate, water solution	20 gm. CrO_3 1.5 gm. Na_2SO_4 100 ml. water	**Zinc** zinc alloys.

The specimen, if now observed under the microscope, will show inclusions of graphite, slag, or other dark, precipitated material against a bright homogeneous background. To show the structure of this background the surface is treated with an etchant. An etchant may produce the desired result by uneven attack upon different constituents of the metal, producing a light-dispersing surface; it may stain one constituent and not another; or it may deposit a colored precipitate over a particular constituent. Some of the commonly used etchants and the metal to which they are applied are listed in Table 1.

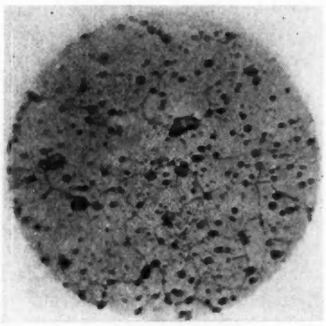

FIGURE 2
Wrought Iron, Transverse action. (100d).

Wrought iron is etched by immersion in alcohol-nitric acid solution 15 seconds (or picric acid solution, 30 seconds), washing in alcohol and drying. The *ferrite* grains should be clearly outlined and the slag particles should be dark (Figure 2).

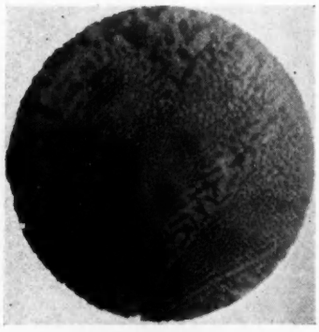

FIGURE 3
Phosphorous segregation in steel.
Phosphorous 10.2 percent. (350 d).

Cast iron is etched with Stead's reagent to bring out *phosphorous* segregation. Several drops of the etchant are placed on the polished surface for a minute and shaken off. More of etchant is placed on the specimen for the same length of time. It is washed in boiling water and then in methyl alcohol. The phosphorous segregations will be covered with deposited copper (Figure 3).

Sulfur printing: Segregated sulfur is brought out in iron and steel if silk strips, saturated with the reagent given in the table, are pressed on the polished surface. The acid liberates H_2S which reacts with the mercury salt and precipitates black mercuric sulfide on the segregation (Figure 4).

The three procedures, just given, should enable the reader to test a large number of metals for the commonly occurring structural faults. For a more detailed discussion of applied metallography the reader is re-

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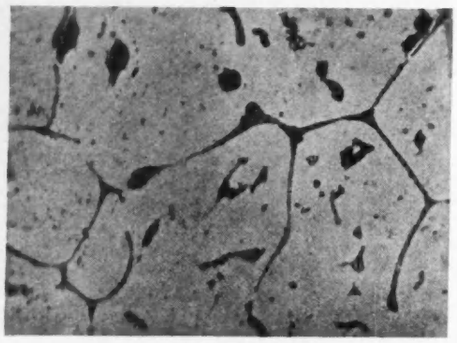

FIGURE 4
Sulfur segregation in steel.
Sulfur .54 percent. (300 d).

ferred to the many fine texts on the subject, a few of which are listed at the end of this article.

Terms Used for Descriptions

Let us now discuss and define the terms used by metallographers in describing the more common grain structures.

Iron.

Iron and its alloys are the most important materials for the equipments of the oil industry. One produces iron from ores, in which it is combined with oxygen, carbon dioxide or sulfur. The industry never uses pure iron, but so-called technical iron, that is an alloy of iron and carbon, silicon, manganese, phosphorous or other elements. The grain structures are characteristic for these alloys and their properties.

α, β, γ and δ (the first four letters of the Greek alphabet) designate the four allotropic forms of pure iron of ferrite. α-iron exists at room temperature; β-iron is stable above 768° C.; γ-iron is stable by 900° C.; and δ-iron exists above 1400° C. α- and β-iron are capable of forming solid solutions, one in the other, but, γ-iron is not found in solid solution with α- or β-iron.

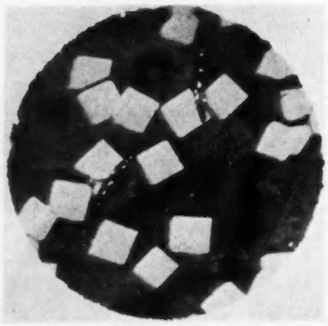

FIGURE 5
Cubic crystals of iron. (250 d).

Figure 5 shows cubic crystals of pure iron (obtained by reduction of ferric chloride). It is thought that ferrite grains in solid iron consist of great numbers of sub-microscopic cubes similar to but smaller than those of Figure 5 (see Figures 2, 4). The term ferrite designates crystalline grains of iron substantially free of carbon and impurities. Ferrite may contain .05 percent carbon, 4 percent silicon, or 0.7 percent manganese without altering the microscopic appearance of the grains.

Pearlite grains appear in iron when the carbon content exceeds .05 percent. It contains .89 percent carbon by weight and has a thread-like structure and a pearly luster when viewed under the microscope (Figure 6). As the percentage of carbon becomes greater, the amount of pearlite increases and ferrite disappears. When carbon reaches the critical value of .89 percent, 100 percent pearlite is present and all the ferrite has disappeared (Figure 7).

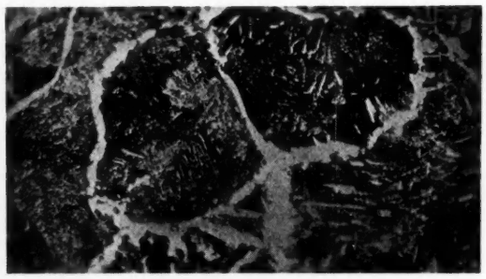

FIGURE 6
Hypo-eutectoid steel. Carbon .50 percent.
(100 d).

Cementite or *iron carbide* is formed when carbon exceeds .89 percent (Figure 7a). It appears in the form of bright, white networks surrounding the grains of

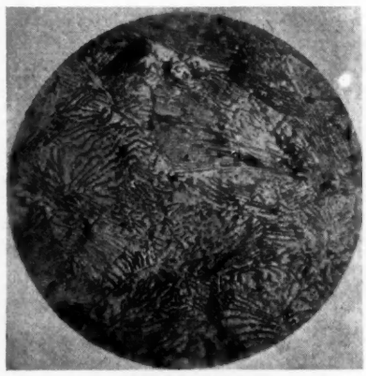

FIGURE 7
Eutectoid steel. Carbon
.89 percent. (410 d).

pearlite or as bright, white needles piercing the dark grains of pearlite (Figure 8). The similarity between ferrite and cementite is often confusing at first. They are similar in appearance only, *ferrite is soft* and may be scratched with a pin, while *cementite is very hard.* Also ferrite is usually slightly discolored by the etchant and cementite is not.

Steels are also classified as hypo-eutectoid, eutectoid, and hyper-eutectoid with reference to their carbon content. The term *eutectoid* designates steel which has enough carbon to form 100 percent pearlite; the prefix hypo-indicates steel that has less than enough carbon; and the prefix hyper- indicates steel having more than

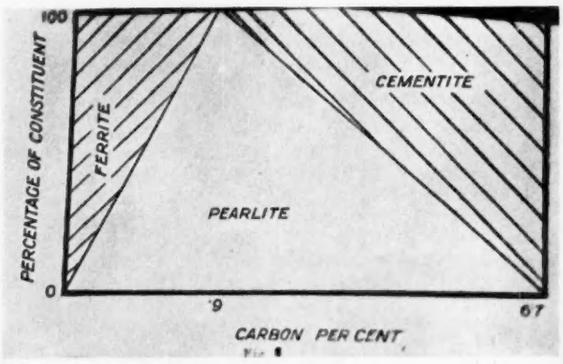

FIGURE 7a
Ferrite-pearlite-cementite diagram.

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FIGURE 8
Hyper-eutectoid steel. Carbon 1.43 percent. (410 d).

enough carbon to form 100 percent pearlite, but less than 1.7 percent carbon. Iron containing more than 1.7 percent carbon and less than 4.3 percent is called hypo-eutectic; 4.3 percent, *eutectic*; and more than 4.3 percent, hyper-eutectic. *Eutectic* mixtures are those in which the components separate from the liquid mixture at the same temperature, while in *eutectoid* mixtures the components separate as crystals from the solid solution at the same temperature. Thus, in eutectoid steel, crystals of ferrite and iron carbide (Fe_3C) separate simultaneously giving rise to single grains of pearlite.

The terms just defined apply to iron and steels that have been heated to a temperature near the melting point and allowed to cool slowly in the furnace. Because of the allotropic nature of pure iron one would expect an alteration in the grain structure of its alloys as they are heated or cooled through the critical temperatures. This is exactly what happens! The transition of one type of structure to another at the critical temperature is rather slow in steel and advantage of this has been taken to produce a great number of modified grain structures.

As an illustration of the effect of temperature on structure, let us consider hypo-eutectoid steel with .30 percent carbon at 1500° C. At this temperature the metal is liquid. As the metal cools a solid solution of carbon in γ-iron will begin to separate and at 1400° C. the steel will have completely solidified. Between this temperature and about 800° C. the alloy is a solid solution of carbon in γ-iron and is called *austenite*. The critical range for this steel is 800-700° C. Between these temperatures complex shifting of the grain structure takes place several times. If the cooling is slow, some ferrite will be precipitated out and the solid solution will have a modified structure called austenite-*martensite*. As cooling progresses more ferrite is thrown out and the solid solution is modified further to a structure called martensite-*troostite*. When all the martensite has been changed to troostite and cooling progresses, the structure is again modified to one called troostite-*sorbite*. Slightly above the lower critical temperature, when transition of troostitic to sorbitic structure is complete, more ferrite is precipitated and the structure of the remaining solid solution is called sorbite-*pearlite*. At 700° C. this final transition is completed and the alloy has the structure ferrite-pearlite which was previously discussed.

By controlled rate of cooling steels may be obtained with the following structures: ferrite-pearlite; ferrite-pearlite-sorbite; ferrite-sorbite; ferrite-troostite-sorbite; and ferrite-troostite-martensite. The last named structure is obtained by rapid cooling from above the upper critical temperature in water or brine. The cooling of hyper-eutectoid steel can be explained in a similar manner; cementite is precipitated out, however, and not ferrite.

The following table shows the *relative hardness of the structures,* ferrite being taken as unity:

Ferrite	1	Austenite	104
Pearlite	43	Martensite	239
Sorbite	52	Cementite	272
Troostite	88		

Annealing or Spheroiding

Water is the cheapest and most convenient quenching agent and is therefore used whenever possible. The resulting steel may have several undesirable features; it may be brittle due to large grain size or it may be too hard for easy machining. A second heat treatment is applied and is called *spheroidizing* or *annealing,* depending upon the desired result. Spheroidizing converts the laminated pearlitic structure to a globular pearlitic structure. The purpose of annealing is to produce a *softer steel.* This is done by heating the metal near its lower critical range and allowing transition to a softer structure to take place. Figure 9 shows carbon steel quenched in water and tempered.

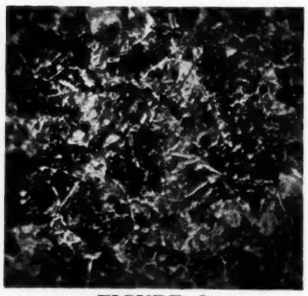

FIGURE 9
Carbon steel forging.
Ferrite-troostite-sorbite. (100 d).

When chromium is added to steel, it combines with all the carbon present to form the extremely hard double carbide of chromium and iron. Chromium in excess of the amount required for the carbon remains in solid solution in the ferrite grains. The effect of chromium in small amounts is the refining of the grain. A great hardness can be obtained without the accompanying brittleness found in iron-carbon steels. An adverse effect of chromium is the impoverishment of carbon in the hard eutectoid structure. An alloy containing 18 percent chromium and .25 percent carbon can not be hardened, because martensite is not found upon quenching. The addition of 2 percent *nickel,* however, restores this property (Figure 10). Nickel does not form a carbide and remains in solid solution in ferrite as does *silicon.* The carbide forming metals are chromium, manganese, tungsten, molybdenum and vanadium.

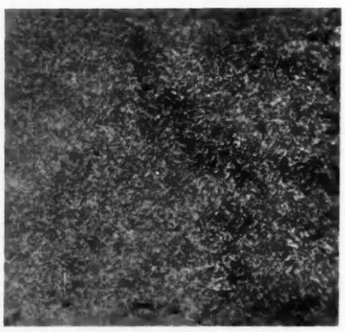

FIGURE 10
Chrome-nickel steel.
Uniform sorbite. (100 d).

The corrosion resisting property of chromium has

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been termed passivity. It lies in the ability of the metal to form a protective coating of oxygen on its surface. Chromium imparts passivity to its alloys when they are properly heat treated. Improper treatment of chrome-steel precipitates chromium as the carbide and the alloy becomes active. The failure of chrome- or chrome-nickel-steel tubes may usually be assigned to this fault. The carbide is precipitated near welds in chrome-nickel-steel pipes if the amount of nickel is not high enough to maintain the chromium in solid solution. *Molybdenum* extends the passivity range of chromium because of its greater affinity for carbon. It also increases resistance to hydrochloric acid corrosion. *Titanium* and *columbium* are likewise very effective even in amounts less than .5 percent. *Silicon* is not recommended as a supplement to nickel where the alloy is exposed to an atmosphere rich in hydrogen sulfide; especially not at elevated temperatures. *Tungsten* is similar in effect to molybdenum and is used to the extent of 2.5-3.5 percent. Chrome-nickel steel has a carburizing tendency (i.e., a tendency to absorb carbon into its surface). This is especially noted where the metal is exposed to hot flue gases. *Aluminum* is added to the surface in a process called *"calorizing"* to prevent this tendency. *Copper* in small amounts increases resistance to brine and hydrochloric acid.

Finally, we want to speak a few words upon the properties of the different sorts of iron and steel. There is the *pig iron,* which comes directly from the blast furnace; it contains many impurities of the ores, coals and fluxes and must be purified in special processes (Bessemer-, Thomas-Gilchrist-, Siemens-Martin-, crucible cast steel-, or electric furnace method). Then results *ingot iron, ingot steel, refined steel* etc.

Generally, we can say, that the malleability of iron is the best if the carbon content is less than 1 percent; and it is very much reduced, if the iron contains sulfur, silicon or manganese. The greater the malleability is, the better the iron can be welded; only the manganese content must remain less than 1 percent. The hardness is influenced by carbon, manganese, nickel, chromim, etc., but with it increases the brittleness. A very high hardness without brittleness possess steels with a certain content of chromium, tungsten, nickel, manganese, etc., while the presence of phosphorous, oxygen or sulfur harms (because the brittleness increases). The amount of other elements in the iron varies very much the tenacity, especially the elasticity, the toughness and the breaking test.

To reduce the danger of corrosion, we use alloys of iron and chromium, nickel, tungsten, molybdenum, titanium, etc. There are possibilities for corrosion of iron in the oil fields, especially for the pipe lines, pump valves, tanks, and poles of the drilling equipments. Corrosive agents are hydrochloric acid, sulfuric acid, carbon dioxide in water; magnesium chloride and other salts; oxygen, hydrogen sulfide, and so forth.

For oil tanks, where sulfide often corrodes the metals, now chrome-and-nickel-steels are used. For pipes (oil, water, gas, waste water lines, and for lining the drill holes), mostly a sort of Siemens-Martin steel is useful. For pipes which lie on the surface of the earth, steel with a .2 to .35 percent copper is recommended. Steels with a small amount of chromium, nickel or molybdenum are good for the poles and rods of the drilling equipment.

Non-Ferrous Metals

For withstanding increasingly severe corrosion conditions in the refinery especially, the chrome-nickel steels are being displaced in favor of several recently developed non-ferrous alloys; those having a *copper* base being the most popular at the present. H. M. Wilten, writing in "Mining and Metallurgy" (March, 1937, p. 143), discusses the experience of a Texas company with several metals in shell- and tube-type condensers and exchangers. The metals used were 18 percent chromium, 8 percent nickel steel, admirality metal (i. e. copper 70 percent, tin .90-1.20 percent, lead .75 percent, iron .06 percent, zinc 29 percent); 4 to 6 percent chromium, 5 percent molybdenum galvanized steel (.4 percent copper, .08 percent molybdenum). The results show admirality metal to be the most satisfactory under the conditions obtaining.

Tubes of admirality metal fabricated in Great Britain are usually hard drawn and are more resistant to mechanical abrasion than the finish annealed tubing of American manufacture. The softer variety, in which the zinc granules have been spheroidized, is more resistant to chemical attack. It is believed that tinning the surface of the metal most exposed to corrosion lengthens the life of the tube.

Other copper base alloys offered as corrosion resistant tubing are: *Ambrac* (copper—75 percent, nickel—20 percent, Zn—5 percent); *Everdur* (copper—94.8 percent, silicon—4 percent, manganese—1.2 percent); *Calsun* (copper—96.1 percent, aluminum—2.3 percent, tin —1.6 percent); *Tempaloy* (copper—95 percent, nickel —4 percent, silicon—1 percent); *Herculoy* (copper 96.25 percent, silicon 3-3.25 percent, tin .5 percent).

The copper base alloys may be given a wide range of properties by varying their composition, heat treatment or mechanical treatment. All alloys rich in copper have points of resemblance in their grain structure. The addition of a metal other than lead or bismuth results in a solid solution being formed. The changes in structure that occur as the copper content decreases, are quite involved and in many cases have not been investigated. The case of copper and nickel alloy is exceptional: solid solution is quite regular for these two metals from 100 percent copper to 100 percent nickel. In other words: nickel is infinitely soluble in copper. Next in solubility to nickel is *zinc*; but in this case complications arise. When 39 percent zinc is added, the copper becomes saturated and the structure is said to be 100 percent copper-*brass.* Further addition of zinc up 46 percent gives rise to a second constituent in the structure known as β-brass. Between 46 percent and 50 percent zinc, only β-brass is existant at ordinary temperatures. More than 50 percent zinc gives rise to a structure designated β-γ-brass. Brass containing 58 to 60 percent zinc is known as γ-brass. These higher brasses are very brittle and easily corroded; therefore, they are of little commercial value. Near the critical concentrations of zinc, just given, the composition of the brass structure can be altered by heat treatment or addition of an alloying metal. The addition of a metal reduces the solubility of zinc in copper and has the effect (upon the structure at least) of an increase in zinc

FIGURE 11
Copper-zinc-tin alloy.
Tin 15.8 percent. (100 d).

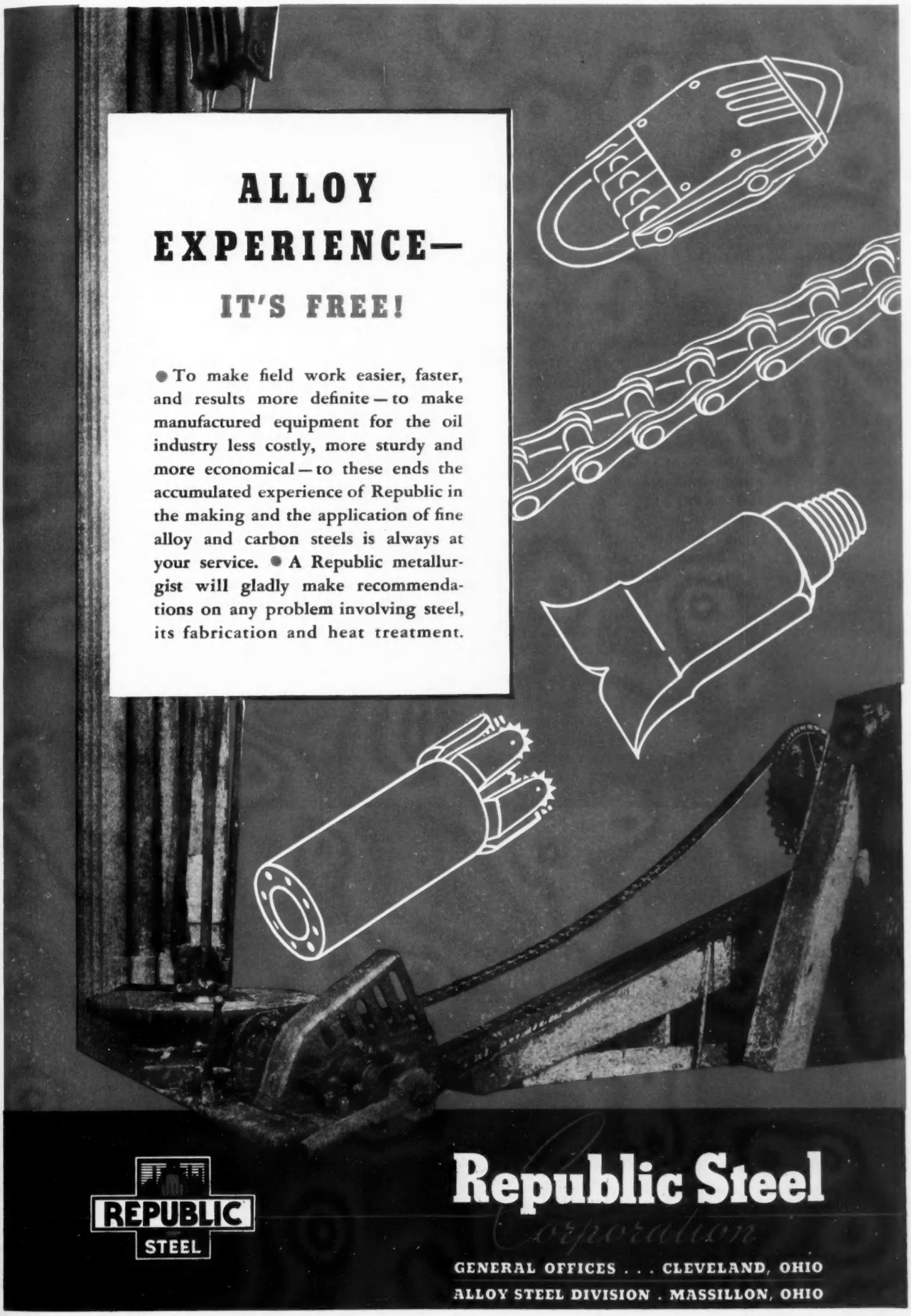
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FIGURE 12
Copper-alluminum alloy. Copper 8 percent. (100 d).

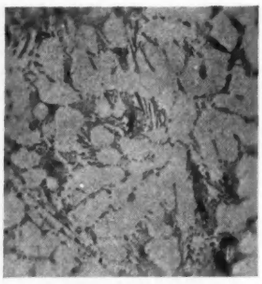

FIGURE 13
Nickel-aluminum alloy. Nickel 4.3 percent. (110 d).

concentration besides bringing the characteristics of the metal to the alloy. α-brass can be worked cold without fracturing; β-brass must be worked hot; γ-brass is not safely worked either hot or cold. Figure 11 shows the structure of an alloy similar to admirality but containing 15.8 percent tin. The white, rounded grains are annealed α-masses; the dark groundmass is β-constituent.

Aluminum and its alloys are becoming increasingly popular with the petroleum industry. Aluminum is quite resistant to the attack of hydrogen sulfide at atmospheric pressure and below 118° C. It has been used successfully as roofing material in storage tanks for high sulfur crudes and in run-down tanks. Aluminum sheathing may be applied to a wooden deck in the case of crude-tanks to lower the cost. Other tank equipment items made of aluminum are: working parts of tank breathers; flame arrestors; and floats and chains for automatic gages. All alkalis attack aluminum. The corroding effect of natural waters can be inhibited by small concentrations of sodium bichromate. The tensile strength of aluminum is too low for use in modern pressure equipment. Alloys have been developed with a tensile strength approaching that of mild steel; sadly though, most of the common alloying metals except manganese lower the corrosion resistance of aluminum. *Aluminum bronzes* (aluminum, copper, zinc) are subject to heat treatment by which the corrosion resistance is greatly improved. *Copper-aluminum alloy* is corrosion resistant as long as the copper stays in solid solution. It is only slightly soluble (.5 percent at ordinary temperatures); an excess of copper precipitates out the eutectic Al_2Cu. The eutectic solution of copper-aluminum occurs with 32 percent copper. Figure 12 shows the structure of a copper-aluminum alloy (copper—8 percent).

Silicon-aluminum alloys are less easily corroded than the copper-alloys and can be compared in several ways with the *manganese alloys*. The silicon eutectic contains 11.6 percent silicon, but alloys have been produced containing as high as 14 percent silicon without precipitation of primary silicon. Magnesium, when added to a silicon-aluminum alloy, combines with the silicon forming the silicide Mg_2Si. If copper is present, a type of heat treatment will precipitate both $CuAl_2$ and Mg_2Si in a finely dispersed state giving an alloy similar to the famous *"Y"-alloy and Duralumin*. "Y"-alloy contains nickel and Duralumin contains manganese. Figure 13 shows the structure of nickel-aluminum alloy (nickel 4.3 percent): the feathery segregations are the eutectic $NiAl_3$.

Metal Spraying has gained favor recently as a method of preventing corrosion. *Tin* and *zinc* can be sprayed by means of an oxy-acetylene gun upon almost any metallic surface. The value of the surface depends upon a tightly adhering, uniform film being formed. A sand blast is usually used to clean metals receiving this equipment. Some success has been obtained with sprayed *lead* also. *Lead lined pipes* have been used to good advantage in the transfer of corrosive fluids.

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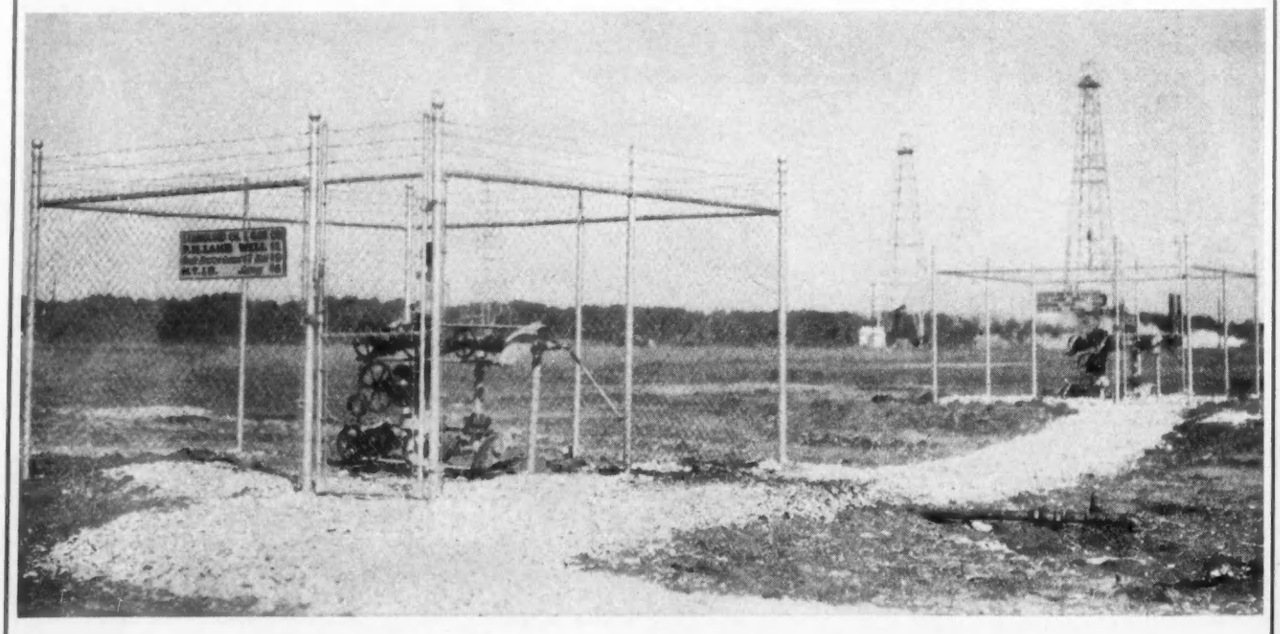

"Twin" wells at South Houston, Texas Coast. One produces from Miocene and the other from Oligocene formations.

Heat Treatment of Steel

PRACTICAL MEANS OF CONTROLLING VARIOUS PHYSICAL PROPERTIES

By Research and Development Division, Jones & Laughlin, Steel Corporation

ONE of the most valuable properties of steel is its remarkable response to heat treatment. The same piece of steel may be either hard and brittle, or soft and tough, or it may display various combinations of these properties, depending on its composition and the heat treatment to which it has been subjected. This unusual behavior of steel is due largely to the fact that iron, which is the predominant constituent of steels, has several allotropic forms, which are stable only within certain temperature ranges. These allotropic forms are characterized by two distinct arrangements of the atoms within the iron crystal:

Form of Iron	Range of Stability	Crystal Structure
Alpha	Below 1663° F. (906° C.)	Body-Centered Cube
Gamma	1663-2557° F. (906-1402° C.)	Face-Centered Cube
Delta	2557-2800° F. (1402-1538° C.)	Body-Centered Cube

Carbon, as well as other elements present in the steel, lower the range of stability of gamma iron. In a steel containing .50 carbon, for instance, the lowest temperature at which gamma iron is stable lies in the neighborhood of 1450° F. (780° C.). When the carbon content is .85 percent, the lower limit of stability of gamma iron is approximately 1337° F.

The change from one allotropic form of iron into another is termed transformation and the temperature at which transformation occurs is called critical temperature. The temperature above which gamma iron is stable is termed the upper critical temperature, while the temperature below which alpha iron is stable is termed the lower critical temperature.

While the basic difference between gamma and alpha iron is the atomic arrangement in their crystal structure, from the steel user's point of view, a more important difference between the two allotropic forms of iron is in their ability to hold carbon in solution. Gamma iron can retain up to 1.75 percent carbon in solid solution, while alpha iron can hold only a few thousandths of one percent. This difference between alpha and gamma iron may be said to be the cornerstone upon which the science of heat-treatment of steel is founded, and it permits the attainment of a wide variety of physical properties by variation of the heat-treating practice. To understand the basic principal of heat-treatment it is only essential to remember that when a piece of steel is heated to above its upper critical temperature for a sufficient period of time the iron changes from alpha iron to gamma, which dissolves all the carbon present forming a solid solution called austenite. Austenite is stable so long as the temperature does not drop below the upper critical point. When the steel is cooled below this temperature, austenite is no longer stable and gamma iron begins transforming into alpha iron. At the lower critical temperature the transformation is complete if sufficient time has been allowed, since below this temperature iron can exist in a stable form only in the alpha state. The alpha form cannot hold the carbon in solution and practically all of this carbon is precipitated in the form of carbide of iron which contains by weight 168 parts of iron and 12 parts of carbon. The form of the carbide precipitated is governed by the rate at which the steel is cooled. If this rate of cooling is slow, the carbide is precipitated out in the form of thin plates alternating with plates of alpha iron and results in a so-called lamellar structure. When the rate of cooling is faster, the precipitated carbide particles are smaller and the resultant structures and physical properties of the steel are different. Under extremely rapid cooling rates, the precipitation of carbides may be entirely prevented, in which case they are retained in the alpha iron in a

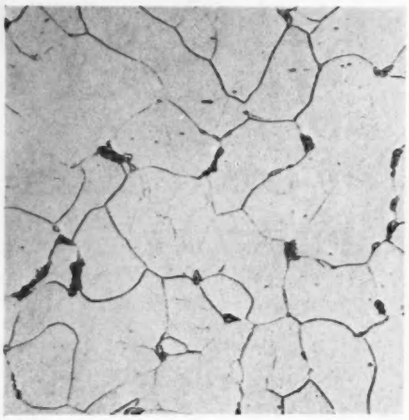

FIGURE 1
200 X **Nital Etch**

Low carbon (.08%) hot rolled structure. The large white areas are grains of ferrite. The dark areas in the grain boundaries are pearlite.

FIGURE 2 (Below)
1500 X **Nital Etch**

Lamellar pearlite. The dark areas are plates of ferrite and the white areas are cementite.

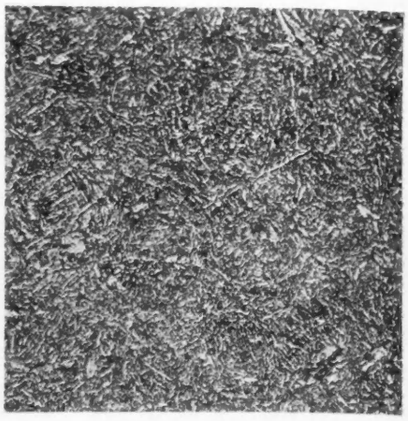

FIGURE 3
500 X **Nital Etch**

Sorbitic structure produced by tempering at 1,000 F.; a quenched medium carbon steel.

forced or "super-saturated" state. Under such conditions the steel would be in an unstable, extremely hard and brittle state.

The different constituents which are revealed by a microscopic examination were in the past given certain specific designations. There is now some question as to the suitability of the classification; however, the names commonly employed are:

Ferrite—Alpha iron with or without various elements in solution. This constituent is soft and ductile. (Figure 1)

Cementite—Iron carbide which is hard and brittle.

Austenite—Gamma iron with carbon and other elements or compounds in solution; this is seldom present at room temperatures in plain carbon steels.

Pearlite—A lamellar arrangement of alpha iron and cementite. Pearlite in plain carbon steels contains approximately .85 carbon or 12.7 percent iron carbide. This constituent is relatively soft. (Figure 2)

Sorbite—Alpha iron with a fine dispersion of carbide particles. It is comparatively hard and tough. (Figure 3)

Troostite—Alpha iron and carbide. A lamellar structure which can be resolved only at very high magnification. It is hard and fairly tough. (Figure 4)

Martensite—Alpha and gamma iron with carbides in a super-saturated state of solution. Under the microscope, martensite appears in the form of needles. This constituent is extremely hard and brittle. (Figure 5)

Each of the constituents described here imparts to steel different properties which are to a large extent a function of the cooling rate. The object of heat-treating is the attainment of a structure which will give the physical properties considered most desirable.

Starting with the slowest rate of cooling various heat-treatments to which steel is generally subjected may be grouped as follows:

Annealing: An annealing treatment is generally used to attain extreme softness and ductility. For this purpose, the steel is slowly heated to above its upper critical temperature and is kept at this temperature for some time, depending on the size of the part to be treated. As a rule the length of heating time is one hour for every linear inch of cross-section of the part. The material is then slowly cooled while it remains in the furnace. Under such treatment all the carbide precipitates out in the form of pearlite. This structure shows a maximum of softness and ductility.

Another important effect of annealing is grain refinement. Hot-rolled steel generally shows a directional effect on the grain structure, i.e., the ferrite and pearlite grains are generally elongated in the direction of rolling. After annealing, the recrystallized

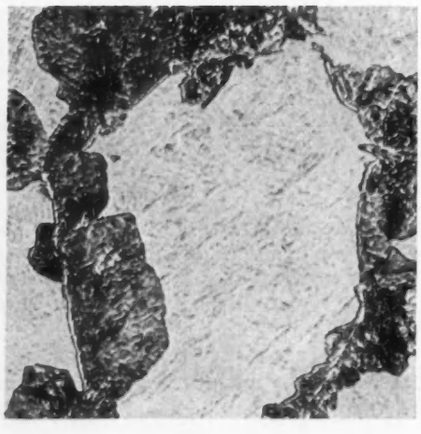

FIGURE 4 (Left)
800 X **Nital Etch**

Troostite (dark areas) resulting from tempering martensite. The light areas are martensite.

FIGURE 5 (Right)
1500 X **Nital Etch**

Martensite needles and austenite (light areas) as a background.

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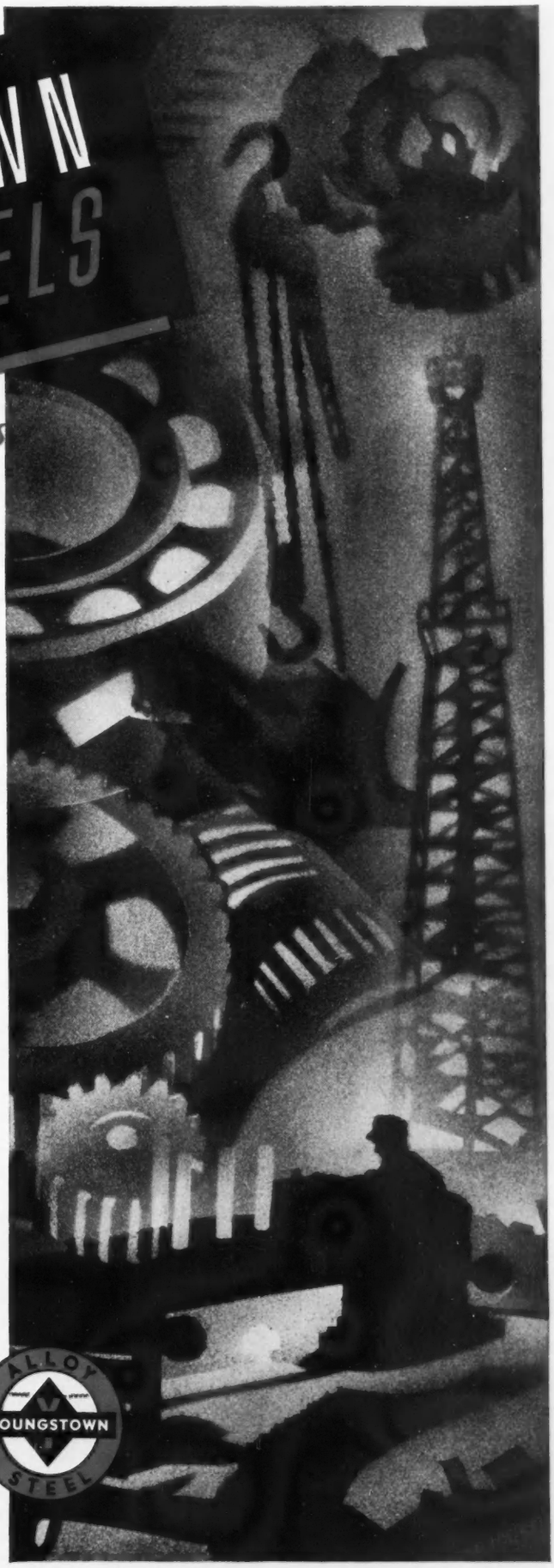

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TABLE I

Effect of Carbon on the Annealing Range

Range of Carbon Content	Range of Annealing Temperature
Less than .12 percent	1600° F. to 1700° F.
.12 to .30 percent	1550° F. to 1600° F.
.30 to .50 percent	1500° F. to 1550° F.
.50 to 1.00 percent	1450° F. to 1500° F.

grains are equiaxial, and do not display a directional effect.

The annealing temperatures recommended by the American Society for Testing Materials are given in Table 1.

Normalizing: The heating in normalizing treatment is carried out at the same rate as in annealing, but the heating temperature is approximately 100° F. higher. The cooling rate is generally somewhat faster, the steel being cooled in air. Due to the higher cooling rate the carbides are usually precipitated in the form of pearlite or sorbite, depending on the size of the article treated. The metal shows greater strength and hardness with only a slightly lower ductility than in annealed metal. The grains are also much finer and show no directional properties.

*Spheroidizing*s This treatment is generally used on high-carbon steel. The object is to change the physical shape of the carbide particles and prevent the formation of pearlite. To accomplish this, the steel is heated to a temperature just below the critical range and kept at this temperature for many hours. Under such a treatment, the carbide separates from the iron, and coalesces into globules which are dispersed in the ferrite matrix. Steel so treated generally exhibits good wearing quality and fair ductility. The treatment is often used on tool steel, or any parts subjected to excessive abrasion. The time necessary for spheroidization is considerably shortened if the steel is subjected to cold work previous to the heat-treatment.

Quenching and Tempering: The treatments discussed so far are used for the purposes of softening and improving the ductility of the steel. In cases where an increase in hardness is desired, the cooling rate must be greatly accelerated so that transformation of iron from the gamma to the alpha state is retarded, and the carbide precipitated out in the form of extremely fine particles or is retained in a state of supersaturated solution in the alpha iron. This is accomplished by quenching the steel from above the critical temperature in some medium which accelerates the cooling rate. For an intermediate carbon steel water is the most commonly used quenching medium. A more drastic cooling rate may be attained by quenching in brine or in water sprayed under pressure. For higher carbon alloy steels, or for heavy sections, oils are generally used, because the more drastic quench in water may cause cracking.

After quenching, steel has very great hardness. Its structure is martensitic or troostitic. Steel having such a structure is very brittle and generally must be subjected to a tempering treatment. Tempering, sometimes spoken of as drawing, consists of reheating the quenched steel to some temperature below the critical range followed by cooling in air or quenching in water. Tempering lowers the hardness, toughens the heat-treated material and releases the hardening strains. The structure of quenched and tempered steel consists generally of very fine sorbite and troostite. Such a structure results in increased strength and hardness, combined with a high degree of toughness. The drawing temperatures generally range from 500° F. to 1000° F., depending on the physical properties required.

Carburizing and Case Hardening: This heat-treatment is based on the ability of iron to dissolve 1.75 percent carbon. The steel parts are packed in a metal box with carburizing compounds consisting of carbonaceous matter. They are then heated to above the critical temperature and kept at that temperature for 8 to 24 hours. Carbon is dissolved in the steel at the surface and forms a layer of high carbon steel. The thickness of this layer may vary from 1/32 to 1/4 inch or more, depending on the carburizing time. The carburized parts are then quenched in oil directly from the carburizing pot, or else they are cooled to room temperature, reheated to 1650° F., and quenched in oil. Where a greater refinement of the core is required the carburized parts are again reheated from 1375° to 1425° F. and quenched in water or oil. After this treatment it is often desirable to temper the material at 300° to 400° F. for strain relieving, although this is not essential except in parts having very large cross-sections.

Case-hardening treatment results in a hard, high-carbon case, having excellent wearing quality, and a tough, low-carbon core. This treatment usually is not applied to steels having a carbon content in excess of .25 percent.

Cyaniding and Nitriding are treatments based on an entirely different principle from that employed in carburizing or ordinary heat-treatment. Extremely effective case-hardening is accomplished by penetration of nitrogen into the steel by dipping it into molten cyanide salts and quenching in water in the case of cyaniding, or by passing gaseous ammonia over it in the case of nitriding. Cyaniding is carried out at a temperature below the critical range, and can be used on any carbon steel. Nitriding is carried out at a temperature in the neighborhood of 1000° F. and can be successfully accomplished only on steel containing more than 1½ percent aluminum and other alloys. In both cyaniding and nitriding the case is exceptionally hard, but is much shallower than in carburizing treatments.

A typical example of the effect of heat treatment is shown in Table II where the physical properties of hot-rolled and normalized Grade "D" casing are given. The normalizing in this instance was done at 1575° to 1600° F. and evidently has raised considerably the ductility and impact toughness. A more drastic treatment, such as quenching and tempering, would change these properties in an even more striking manner.

Although the different heat-treatments briefly mentioned here differ in details of procedure, all may be summarized as a practical means for the control of the physical properties of steel. For any particular application, steel of a suitable composition should be selected and subjected to that heat treatment which produces physical properties suited for the anticipated service conditions.

TABLE II

Typical Physical Properties of Hot Rolled and Normalized Grade "D" Casing

Treatment	Yield Point	Tensile Strength	Percent Elong. In 2"	Percent Red.	Izod Impact Toughness
Hot Rolled.....	62,000	103,000	28.0	40.0	20.0
Normalized.....	60,000	99,000	33.0	50.0	45.0

What We Have Learned in Electric Welding of Alloys

By A. F. DAVIS, Vice President,
The Lincoln Electric Company, Cleveland, Ohio

ADVANCEMENTS in electric welding technique keep pace with newly developed special steels and therefore permits their fabrication for commercial use.

DEVELOPMENT of special steels, by addition of various alloying elements, has been a great contribution to industry. Results are being obtained, today, which were only dreamed about a few years ago. By addition of the more important elements, copper chromium, columbium, manganese, vanadium, molybdenum, nickel, phosphorus, zirconium, etc.,—either singly or in combination—it is possible to construct, manufacture and fabricate structures and products which are much more effective in meeting service requirements than it was before. Regardless of structural or mechanical service requirements, whether it be high tensile strength at low weight, maximum ductility, fatigue, impact, abrasion or corrosion resistance, an alloy added to the metal will enable it to fill the need.

Important though alloys may be industrially, their real development as far as commercial use is concerned has resulted from developments in welding. The modern shielded arc welding process makes it possible to produce joint metal equal to or better than the base metal welded. Therefore, maximum advantage can be obtained from the use of the alloys. An alloy, arc welded with the electrode designed for it, becomes a single, homogeneous unit, as strong at the joints as anywhere else.

Upping of Tensile Strength

The remarkable advancement made in development of welding electrodes is indicated by a comparison of the tensile strength of weld metal obtainable today and that possible 10 years ago.

High tensile steels are made in a number of different alloys by various steel manufacturers. All these steels contain carbon and manganese. Some also contain mo-

FIGURE 1

Free bend test of electric weld in high tensile steel. Specimen showed ductility of 86 per cent elongation in outer fibers. Note flow of metal in bend.

TABLE 1

Increase in Tensile Strength of Electric Arc Weld Metal

1927 Bare or Washed Electrodes	1929 Shielded Arc Electrodes For Mild Steel	1934 Shielded Arc Electrodes For high Tensile Steel	1936 Shielded arc Electrodes For High Tensile Steel
45,000—55,000	65,000—75,000	85,000—100,000	110,000—115,000

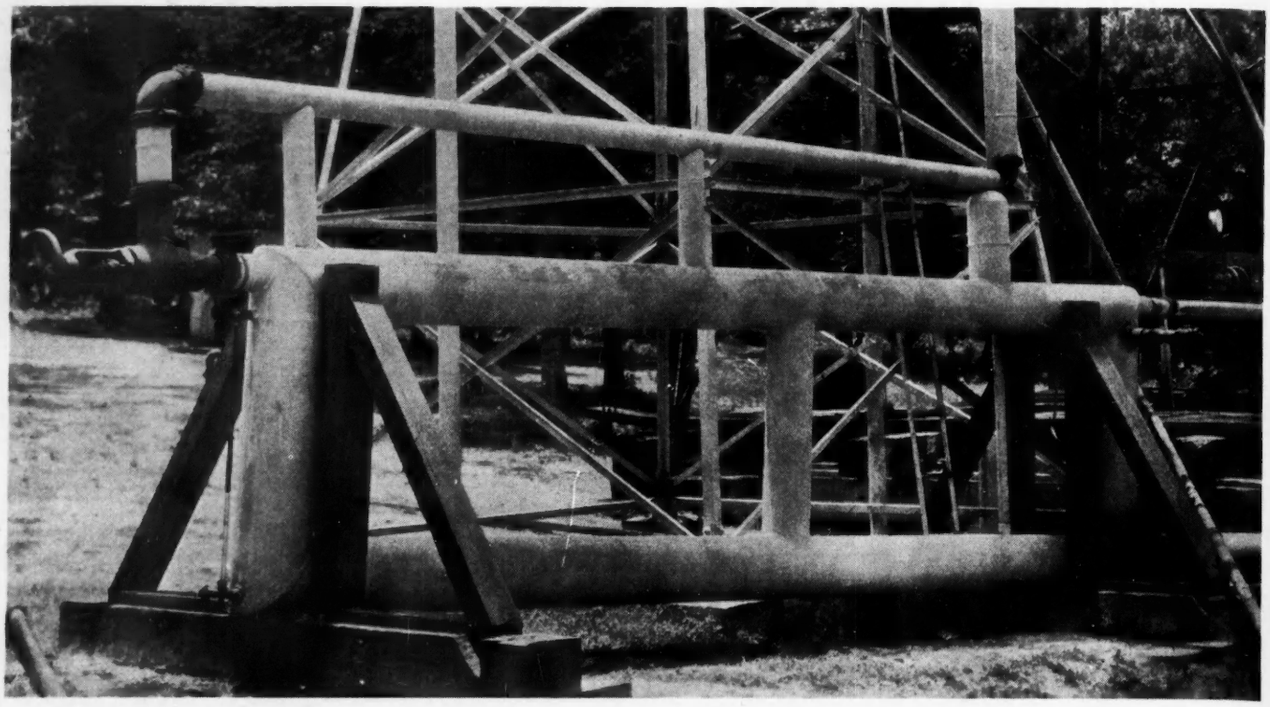

FIGURE 2
Water trap on oil well fabricated and field welded by the electric arc process.

lybdenum, nickel, chromium, silicon, phosphorus and copper and/or other alloys. Six of these steels are listed with their yield points, tensile strength and ductility in Table 2.

TABLE 2
Physical Properties of High Tensile Steels

Name of Steel	Yield Point Lbs. Sq. In.	Ten. Strength Lbs. Sq. In.	Ductility: % Elongation in 2"
Corten	50,000—60,000	65,000—75,000	22—27
Cromensil	60,000	95,000	24
Man-ten	55,000—65,000	80,000—90,000	20—25
R. D. S.	65,000—70,000	74,000—90,000	20—50
Sil-ten	45,000	80,000—90,000	18—23
Yoloy	58,000—73,000	74,000—92,000	29—34

Arc Weld Metal Tensile Exceeds Base Metal

Compare the physical properties shown in Table 2 with the same properties of the weld metal produced with a recently developed high tensile steel welding electrode. (See Table 3.)

TABLE 3
Physical Properties of High Tensile Steel Weld Metal

Yield Point, Lbs. Sq. In.	Ten. Strength Lbs. Sq. In.	Ductility: % Elongation in 2"
90,000	110,000—115,000	15—20

The low carbon content of the steels possessing high physical properties aids weldability. Correct procedure and use of the proper electrode provides welded joints having physical properties at least equal to those of the metal welded. The high quality results obtainable are indicated in Figure 1 which illustrates a free bend test showing a ductility of 86 percent elongation in outer fibers. Note plastic flow of metal inside the weld.

In arc welding high tensile steels, best results are obtained with current of positive polarity, that is, with the electrode positive and the work negative. When the welding is done in flat position, the arc voltage ranges between 24 and 28 volts, in some cases, 30 volts. The currents, for the four sizes are generally about the middle of the ranges shown in Table 4.

TABLE 4
Current Ranges for Four Rod Sizes

Rod Size	Current Range
1/32"	90—175
1/16"	140—225
1/4"	180—325
5/16"	250—400

Vertical or Overhead Welding

For vertical or overhead arc welding of high tensile steels, it is customary to use the 5/32-inch size, except for finish beads on heavy plate, in which case 3/16-inch electrodes are used. In vertical work, best results are obtained by starting at bottom of joint, then building up a shelf of weld metal and completing the weld by weaving the electrode from side to side the full width of the joint. In overhead work, the weld is made with several narrow beads. Each bead is thoroughly cleaned before the next is applied. Vertical or overhead welding is done with currents within the ranges shown in Table 5.

TABLE 5
Current Ranges for Vertical or Overhead Welding

Rod Size	Current Range
1/32"	100—160
1/16"	125—180

The high quality welds available with the electric arc in high tensile steels, and the inherent high physical properties of the steels themselves, make it possible to obtain very superior service life at very moderate cost.

Important 4-6 Chrome Alloys

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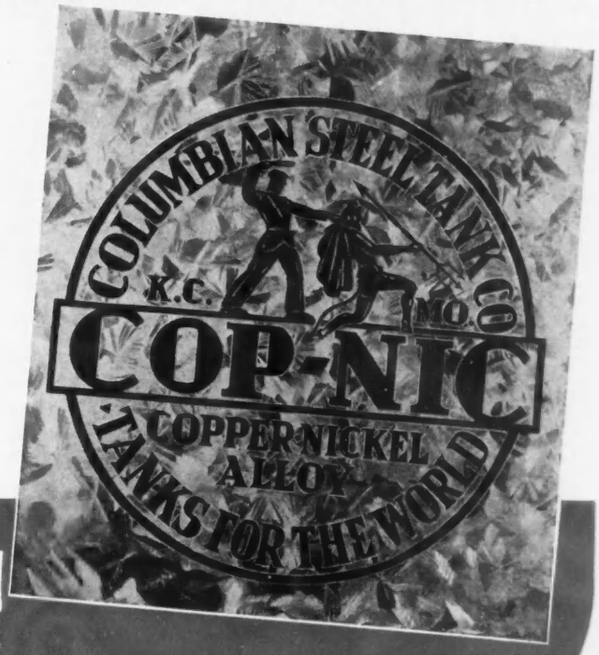

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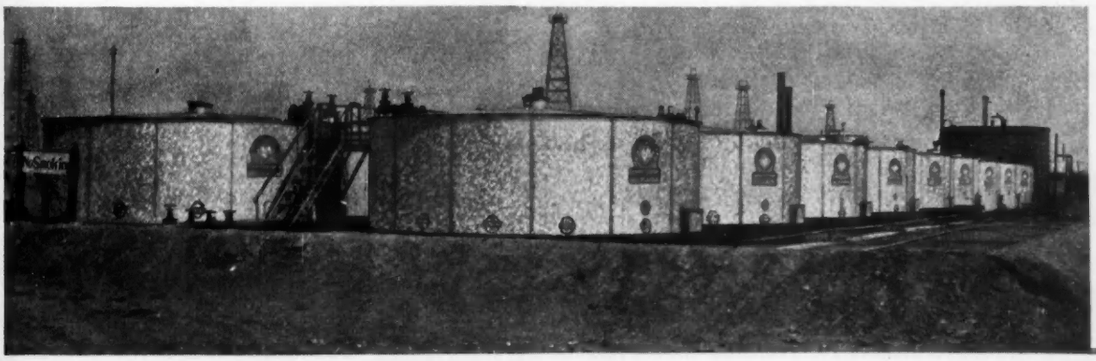

(Left) Battery of Columbian Cop-Nic Galvanized Bolted Steel Tanks in a sour crude field.

See pages 478, 479, 480 and 481 in the Composite Catalog.

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low-alloy high-tensile steels than some of the other alloys, (due to their use in high-speed streamlined trains, etc.), another group of alloys—the 4-6 chrome steels—is receiving increasing attention, particularly in the petroleum industry. These steels contain between 4 and 6 percent chromium and .10 to .25 percent carbon. The 4-6 chrome-alloys have been found of special value where requirements are for high creep strength and marked resistance to crude oil corrosion at high temperatures and pressures. Although the 4-6 chrome steels are usually classified with stainless steels, they possess characteristics and qualities very different from the stainless group. The 4-6 chrome alloys are 4-10 times more resistant to sulphide corrosion and three times more resistant to oxidation at 1000° F. than ordinary steel.

FIGURE 4

Piping for headers on boosters is an excellent application for arc welding with 4-6 chrome alloy welding electrodes due to unusual resistance to oxidation of such welds.

The 4-6 chrome alloys are successfully arc welded by using an electrode developed particularly for the work. Special welding procedure is employed, since the metal has a tendency to harden when exposed to the air after being heated. The welding is done with current of positive polarity, that is, with the electrode positive and the work negative. Currents and voltages somewhat lower than those employed in welding other steels by the shielded arc process are used. Table 6 shows the ranges used for welding these steels.

TABLE 6

Current Ranges for 4-6 Chrome Alloy Arc Welding

Rod Size	Current Range	Arc Volts
1/8"	75—100	22—23
5/32"	100—150	24—25
3/16"	125—200	26—27

Parts of 4-6 chrome alloy to be welded are preheated to a temperature of at least 300° F. If possible, 400° or 500° is employed. The 300° temperature is maintained in the weld and adjacent area at all times during the welding. Immediately after welding, the work is transferred to an annealing furnace. Depending upon the result wanted, one of two heat treatments is employed.

To obtain welds in the 4-6 chrome alloys having approximately 65,000 to 70,000 pounds per square inch tensile strength, 35,000 to 40,000 pounds per square inch yield point, 35 to 40 percent elongation in 2 inches, 65 to 75 percent reduction of area and 130-140 hardness (Brinell), the work after being welded is fully annealed at 1550° to 1600° F. and slowly cooled in the furnace. If desired, work can be air cooled from 1200° F.

To obtain welds in the 4-6 chrome alloys having approximately 80,000 to 90,000 pounds per square inch tensile strength, 55,000 to 65,000 pounds per square inch yield point, 24 to 30 percent elongation in 2 inches, 60 to 70 percent reduction of area, 155 to 175 hardness (Brinell), the work after welding is stress relieved at 1400° F.

Interesting possibilities are available with 4-6 chrome alloys due to their physical properties. In the first place such alloys can be soft annealed to physical properties similar to those of mild carbon steels, consequently are suitable for equipment where severe cold working is applied during fabrication. Secondly, a metal having high yield points and tensile strengths, combined with excellent ductility and impact toughness, can be produced by simple air hardening treatments of the 4-6 alloys. These possibilities suggest a wide range of applications for these important steels. The use of welding permits obtaining all the possible advantages. Since the weld metal produced with proper procedure and the correct electrode is similar to the base metal in physical properties, structures arc welded of the 4-6 alloys are as homogeneous as though they were a single piece of the metal.

Further developments are bound to come in alloys as needs for materials to meet new service requirements are indicated in industry. And, as in the past, development and commercial use of the alloys will be coincident to further developments and progress in welding.

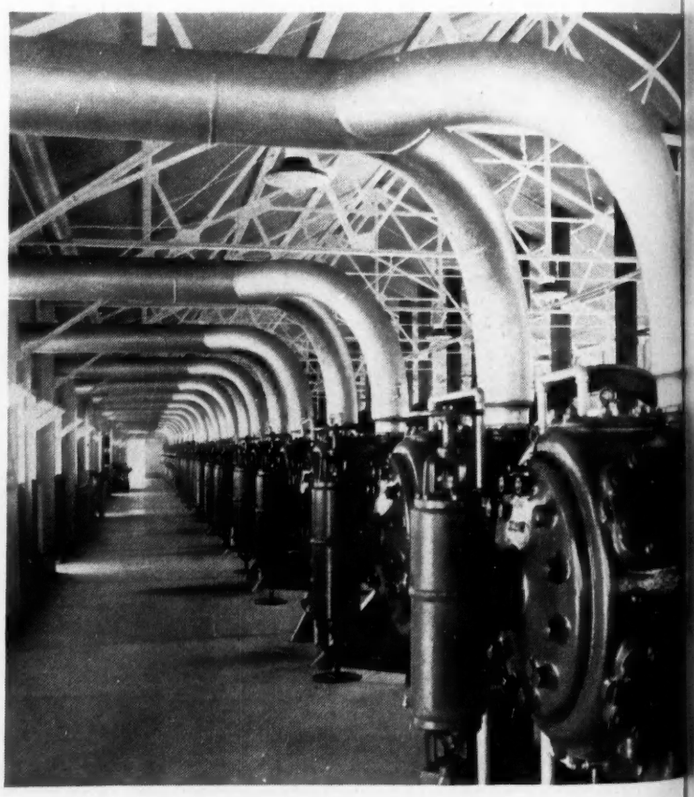


FIGURE 3

A lift station showing weld piping.

The Oil Corrosion Problem

By GUSTAV EGLOFF,
Universal Oil Products Company,
Research Laboratories, Chicago, Illinois

THE corrosion of metals is one of the world's most vital and important problems, and is the most difficult to solve from the economic and technical standpoint. One may say, in general, that practically no type corrosion is insurmountable—but the price is prohibitive at the moment.

Every metal under commercial use will corrode. Rusting of iron, the outstanding structural material, is the foremost problem in corrosion. The destructive forces of corrosion are ever present regardless of where iron or steel is used. The world's corrosion bill is tremendous and the mere cost of replacement of metals is an economic waste which yearly costs the world over two billion dollars, of which the losses in the United States are over a billion dollars. The corrosion invoice for the oil industry throughout the world was of the order of 250 million dollars for the year 1936.

By reason of the range and variety of its operations, the oil industry is in a peculiarly unfavorable position as regards corrosion. There is scarcely a form which it takes that is not encountered in handling crude oil. The spheres of petroleum production, transportation, storage, refining, and utilization must combat its own corrosion problems.

The damage by corrosion continues despite earnest endeavors to solve the many problems involved. The workers engaged in the study of corrosion are numbered by thousands. The theories which have been advanced to account for the rusting of iron alone would fill volumes. To combat corrosion, every resource of science and technology has been called upon. The metallurgist has been a leader in the battle to eliminate or modify the rate of corrosion as a function of metals and its alloys. They have made great strides in solving the problem, but much is yet to be done—which can only result from research of a fundamental and utilitarian character. Remedies by the score have been proposed; alloy steels containing chromium, nickel, molybdenum, aluminum, tungsten, silicon, copper, ceremic coatings, paints, metallic spray, and bituminous coverings, are but a few of the remedies which have been used with some success.

High-priced alloys resist corrosion in some phases of the industry and last a long time; however, the rapid rate of obsolescence in the oil industry makes the replacement of all equipment with alloys not only an enormous expense, but one which is needless in view of the rapidly changing equipment design in many cases.

From the time that drilling for oil starts, clear to the use of gasoline in motor cars, corrosion of all types is present.

Corrosion, in production equipment, casing, and gathering lines, is caused by chemical and electrolytic action of the soil, underground waters, and compounds present in the crude oils such as hydrogen sulfide. In contrast to refinery corrosion, the production equipment is acted upon at ordinary temperatures while refinery practice must combat it at low and high temperatures.

Saline or acid waters, hydrogen sulfide, or other forms of sulfur cause the most severe corrosion on production equipment and wherever these are found the replacement costs are high. Casing failure has two bad features, not only does it call for replacement, but when water is allowed to pass into the casing, it impairs the value of the well and emulsifies the oil. This calls for subsequent treatment which adds to refining difficulties due to hydrolysis of magnesium chloride or other salts producing corrosive hydrochloric acid calling for neutralization with costly chemicals such as ammonia. The salts present in the water, deposit on the heating element of the crude distillation or cracking unit.

The corrosion of casings of wells occurs both internally and externally. Ground waters and moist soil in many cases are strong electrolytes, which act both chemically and electrolytically, causing external corrosion. Electrolytic corrosion is potentially present since a current may be set up between the soil and tube, on different sections of the tube where films were formed, and between the water layers of two different salt concentrations. Internally, corrosion is caused by water accompanying the oil, air, or hydrogen sulfide. Electrolytic decomposition may also start between the tube and films because the saline or acid water and hydrogen sulfide present are good conductors.

Casing is not the only piece of production equipment which corrodes under service in the field, strainers, valves, sucker rods, flow lines, lead lines,

rings and storage tanks are in contact with all the materials causing corrosion.

Gathering and lateral lines are subjected to heavy corrosion primarily due to the fact that the lines are laid through and over salt water drainage areas. Much of the corrosion difficulties could be eliminated by use of protective materials where most of the corrosive waters are in contact with the pipe line. Protective measures have been derived from alloys, special coatings, such as aluminum, plastics, bitumenic material, cements, but the problem still remains, as no one method of tubing protection is satisfactory in all cases due to the manifold differences in corrosive materials to which the tubes are subjected.

Acidizing of wells by hydrochloric acid has increased the hazards of corrosion not alone in wells and pipe line equipment but also refineries. Part of the hydrochloric acid is neutralized by ammonia, however, since it reacts with the oil or forms salts with the lime formation which are suspended in the crude oil, which gives difficulties in distillation or cracking equipment.

In general, pipe line corrosion is due to external causes; however, much internal corrosion takes place due to the moisture, emulsified water, hydrogen sulfide, oxygen, and other components present in the oil and gas. There are over 200,000 miles of pipe lines for the transportation of oil and natural gas. It has been estimated that the annual loss by corrosion averages approximately $300 per mile of pipe line.

A particularly interesting research on natural gas transmission lines was conducted by the United States Bureau of Mines, who found that corrosion in natural gas lines may be due to only traces of hydrogen sulfide, i.e., 12 grains or less per 100 cubic feet of gas. As a part of this work, a transmission line operating at 300 pounds, transporting gas which contained 2 grains or less of hydrogen sulfide per 1,000 cubic feet was studied. Within the last few years several failures have occurred in this line as a result of the thinning of the walls of the pipe.

Internal corrosion of transmission and distribution lines by hydrogen sulfide may be minimized by cement lining the pipe or adding protective films such as lacquers, tars, oils, etc. Corrosion-resisting alloys or metals appear to be too expensive at the moment to use for pipe lines and seem to be limited to use as lining of the pipes with a thin layer of high chrome-steel alloy and aluminum foil.

Many methods have been tested in order to safeguard tanks from corrosion, such as cementing, lining with aluminum or aluminum structure entirely, or coating with lacquers, bitumenic material, with considerable success but the problem is still with us.

Refinery equipment whether at very low temperatures in dewaxing oils at minus 60° F., or cracking temperatures to over 1100° F., has called for new and improved alloys in order to withstand the new-temperature-pressure conditions desired in processing oil for modern lubricants and gasolines.

Probably no more serious factor in corrosion as it affects the oil industry exists than that present in distillation and in cracking equipment in refineries. Corrosive crudes attack almost every part of atmospheric or cracking installations which calls for expensive protective measures or frequent replacement. There is not alone the great monetary loss involved due to expensive alloys but also the high danger of failure of the corroded equipment, bringing about loss of life and fire.

The corrosion of refinery equipment is mainly due to the action of hydrogen sulfide and hydrochloric acid. Hydrogen sulfide gas is dissolved in many crude oils as produced and a greater amount is produced by the cracking of the sulfur compounds in the charging stock. Since the acidizing of wells, apparently an increased content of salts are suspended in the crudes, with the result that they not alone deposit upon the heater tubes, but also act catalytically in producing increased amounts of hydrogen sulfide. Hydrogen sulfide not alone reacts with metals but deposits pyrophoric scale in the inside of distillation equipment which when air contacts therewith may burst into flame.

The amount of hydrogen sulfide formation is not a function of the percentage of sulfur in the original charging stock, since some relatively low sulfur-containing stocks have a higher corrosion rate than one which may contain more than twice as much sulfur.

There are two distinct differences in the action of hydrogen sulfide and hydrogen chloride as corrosive agents. Hydrogen chloride results from hydrolysis of water present in crude oil and appears early in the distillation of the crude. In the absence of water it is, as far as we know, harmless but in the cooler portions of the systems where water condenses, the hydrogen chloride dissolves therein forming hydrochloric acid which is highly corrosive unless combined with a chemical agent such as ammonia or caustic soda. The "hydrochloric acid corrosion zone" includes the heat exchanger, condensers, rundown lines, particularly in places where water may be trapped as around valves and horizontal lines. Some rundown lines have corroded away in 48 hours of use.

Hydrogen sulfide, on the other hand, evolves in many cases throughout the entire course of distillation. Its formation rate depends upon the type of oil distilled and the manner in which the sulfur compounds in the stock break down under thermal conditions. The corrosive effect of hydrogen sulfide manifests itself usually to greatest degree in the hottest portions of the system. The greatest danger due to hydrogen sulfide lies in the high-temperature zone such as flash tubes, reaction chamber, flash chamber, vapor lines, bubble towers, hot-oil pumps, in addition to return bends, plugs, pyrometer wells. With mild steel, reaction chambers have been known to corrode away at the rate of one sixteenth of an inch per month.

There is no question but that alloy steels can be fabricated to withstand the corrosive conditions in the oil industry, but at a relatively high price. In some cases these high-priced alloys have resisted corrosion. It is the task of the metallurgist to develop new alloys so as to cut the cost of combatting corrosion in the oil industry.

Many methods have been used to combat refinery corrosion such as injection of chemicals, alloy steels, calorized tubes, and cements or sprayed metal liners for reaction chambers.

New alloys of proper physical and chemical properties are continually being developed by the metallurgists, and it is hoped that from fundamental researches low-priced alloys will be found to do the job that the high-priced ones of today are accomplishing in the oil industry.

Flow of Mixtures of Oil and Water Through Sand

By F. B. PLUMMER, J. C. HUNTER, JR., and E. H. TIMMERMAN
University of Texas Department of Petroleum Engineering, Austin, Texas

ABSTRACT

THIS paper reviews briefly the factors which affect the proportions of oil and water produced in wells, describes experiments carried out to test the proportionate yield of water and oil in fine-grained sand, and explains how the addition of certain chemicals can reduce the flow of water. Cross-sections of sand cores are exhibited showing the shape of water cones developed around a flowing experimental well, and explanations are offered to account for the shapes of the water cone under different conditions of production. Addition of a soap solution to fresh water reduced the proportion of water produced approximately 70 percent. The same solution added to salt water brines reduced the percent of water only about 10 percent. It is concluded that the soap solution produces a thin film over the surface of sand grains which reduces the flow of water. Since the soap solution does not mix with the oil it does not affect the production of oil. The lower result obtained in salt water is thought to be due to the inability of the soap to dissolve in oil-field brines. It is not claimed that the methods employed in the laboratory are directly applicable in field conditions; it is thought that the experiments may possibly lead to an explanation of certain salt water production problems.

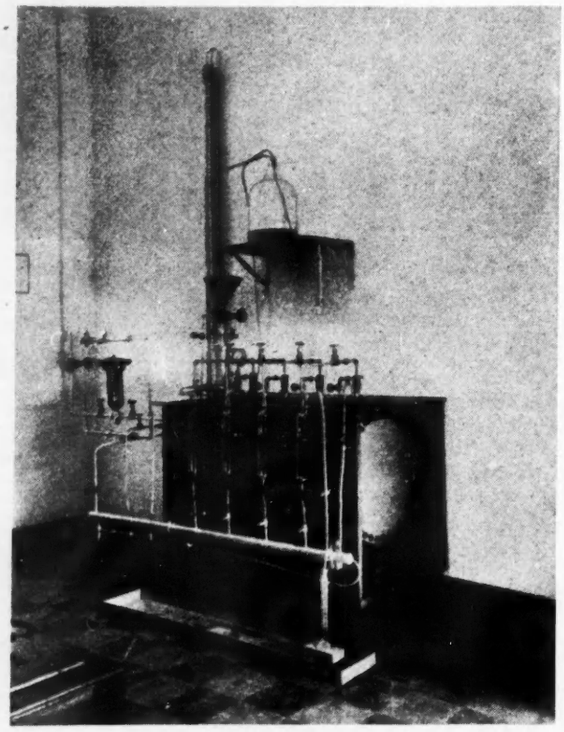
This paper was presented before the Spring Meeting of the Southwestern District, American Petroleum Institute Division of Production. The statements and opinions expressed are those of the authors and should not be construed as official action or opinion of the institute, or of this journal.

REDUCTION of the percent of salt water in oil wells is a major problem in oil production. More than twice as much water as oil is produced in the partially depleted fields of the United States today. The economic loss due to increased pumping costs, handling of emulsified oil, and losses due to unrecoverable oil trapped by water in a sand fully justifies a thorough study of methods of reducing salt water production.

The results of the work by d'Arcy,[1] King,[2] Fancher, Lewis and Barnes,[3] Wyckoff, Botset, and Muskat[4] and others have shown that, when water alone or oil alone flows through sand, the rate of production increases as the pressure, thickness, and permeability of the sand increases, and it decreases as the viscosity and distance the oil has to flow increases. Accordingly, a sand bearing both water and oil should under constant conditions produce water and oil in quantities that are proportional to the viscosities of the two fluids. It is well known, however, that in most fine-grained sands these proportions do not hold. Due to interfacial tensions between the water and oil, to adhesion tensions between the liquids and the sand, factors commonly referred to as capillary phenomena, a much larger proportion of water than oil is obtained from fine-sand reservoirs. It is also well known that in reservoirs having relatively coarse-grained sand and rapid rates of flow, the water "cones" around the well, and an abnormal percentage of water is produced. If the well in the coarse-grained sand is "pinched in" and allowed to produce very slowly, the "cone" is said to be depressed and the proportion of oil to water is generally increased. On the other hand, if a well producing from very fine-grained sand is "pinched in," an increase in the percentage of water production often results.

Aided by a fellowship grant from Shell Petroleum Corporation, investigations have been carried on at the University of Texas to study the factors that affect the water-oil ratios of production from sands having a texture and permeability similar to those in oil fields.

The equipment consists essentially of a large, horizontal, iron reservoir (Figure 1), capable of maintaining a measured pressure delivered from a compressor. A 16-gallon pan containing water and oil is placed inside the reservoir. Dried and thoroughly sieved sand is placed in special screened core holders (Figure 2) and packed tightly between the two brass plates that are drawn together by bolts. The pressed sand is in the form of cylindrical cake or core 4 inches thick and 4 inches in diameter with a hole ¾-inch in diameter extending vertically through the center (Figure 2b). Brass nipples are screwed into the upper plates of the core holders. The holders are then placed inside the iron cylinder and the nipples are connected by means of unions with pipes that extend out through the side of the cylinder. Brass inner tubes ⅛ inch in diameter are then inserted through the outer nipples to the bottom of the sand cores, and are packed off at the outer surface of the cylinder by means of a special tubing head. The finished assembly furnishes an artificial "reservoir" from which oil and water flow from the inner pan through the sand into the bottom of the "well" and thence through the "string of casing" from the "well" to graduated receivers on the outside of the cylinder. The differential pressure between the reservoir and the "bottom of the hole" is measured by a manometer. When air pressure is applied to the reservoir, fluid is forced through the cores to the receivers outside and may be returned as rapidly as produced to the reservoir through a



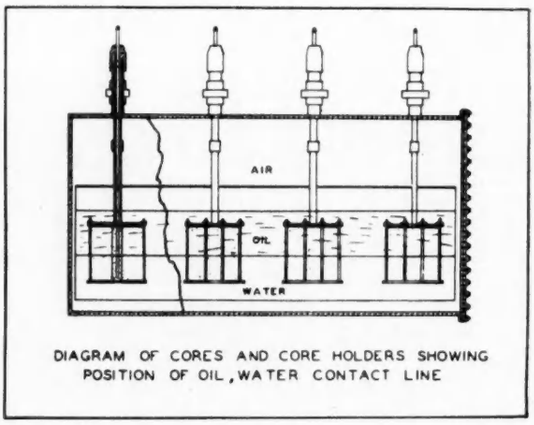


DIAGRAM OF CORES AND CORE HOLDERS SHOWING POSITION OF OIL, WATER CONTACT LINE

FIGURE 1

Apparatus used for measuring flow of oil and water through sand.

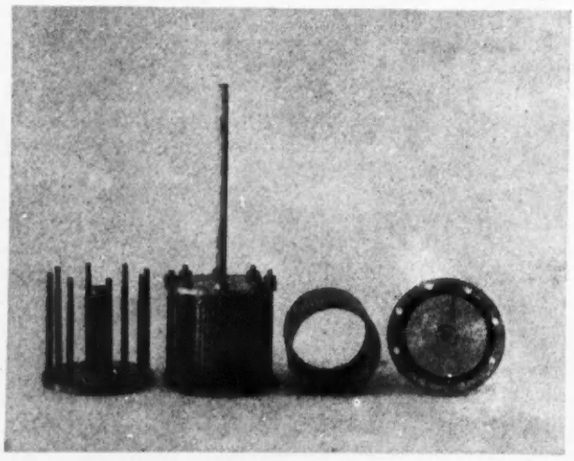
A. (Left) View of outside of pressure cylinder showing flow lines and graduated receivers.

B. (Above) Cross-section of interior of cylinder showing position of the cores in water and oil.

lubricator (L, Figure 1), so that the fluid level inside the reservoir is kept approximately constant. The pressure, the time required for any amount of fluid to be produced, and the ratio of water to oil are recorded for each condition under which the apparatus is operated.

The oil and water in the pan are so proportioned that the contact between the two liquids comes exactly to the middle line on the sand (Figure 1b). The water used in the first experiment had a viscosity of 1 centipoise and the oil a viscosity of 1.65, and the sand grains ranged between .105 and .074 mm. in diameter. A comparison of the viscosities of the two liquids indicate that water production should have been 62.3 percent, and the oil 37.7 percent, if no water "coning" or other interference took place. The sand was wet with oil before it was submerged in the liquids, and oil flowed through first; water gradually broke through and increased to a constant oil-water ratio after a few hours of production.

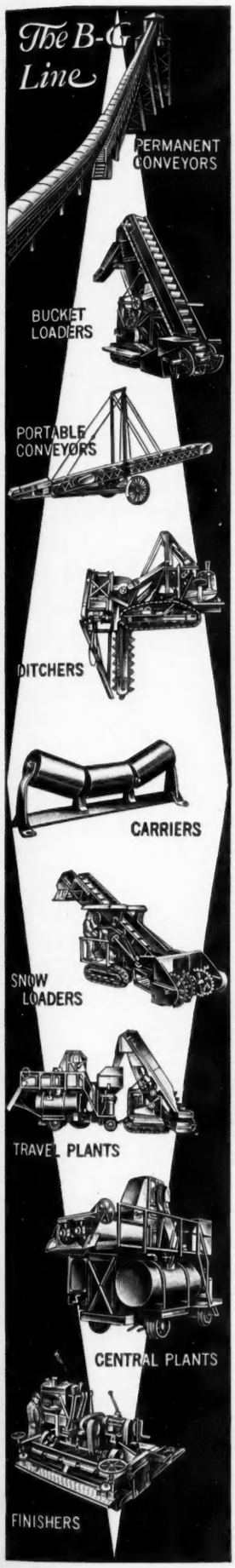
The water-oil ratios under these conditions did not conform to the theoretical percentages, even when the pressure differentials amounted to only a few inches of water. The average water production after a long period of flow and after equilibrium was established was 75 percent and the oil production 25 percent, indicating the presence of a water "cone" in the sand. The cylinder head was then opened, the core holders removed, the supporting plates detached, and the sand cake sliced vertically. The wa-



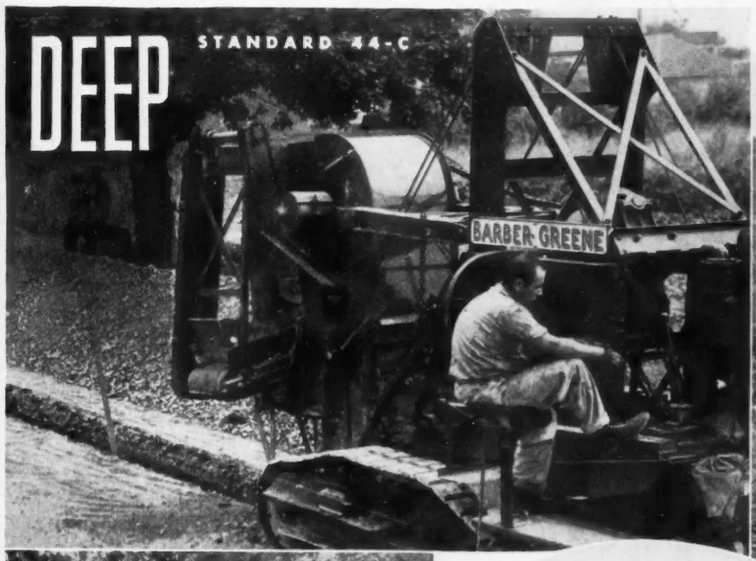
A. Sand containers and screens showing methods of connecting flow lines.

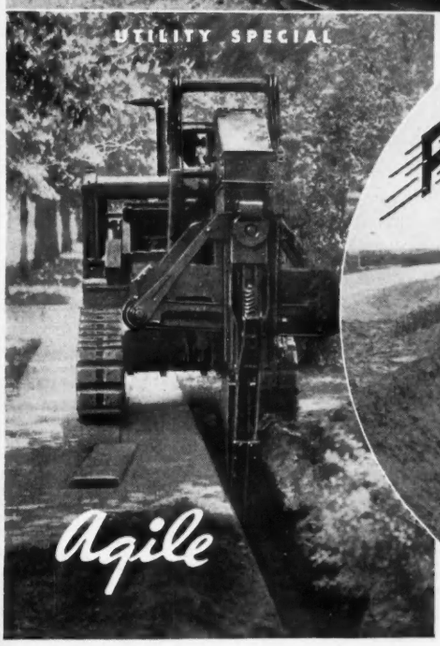
B. Core of sand after removal from core holder.

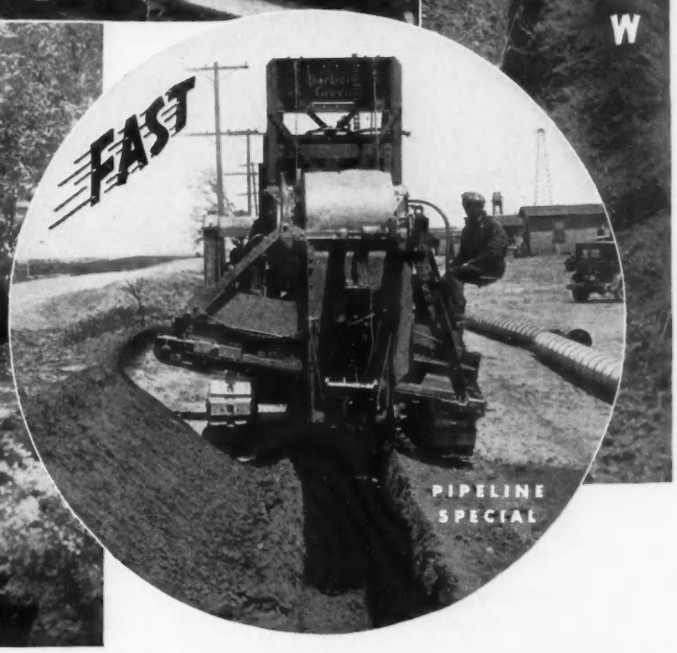
FIGURE 2



4 Barber-Greenes







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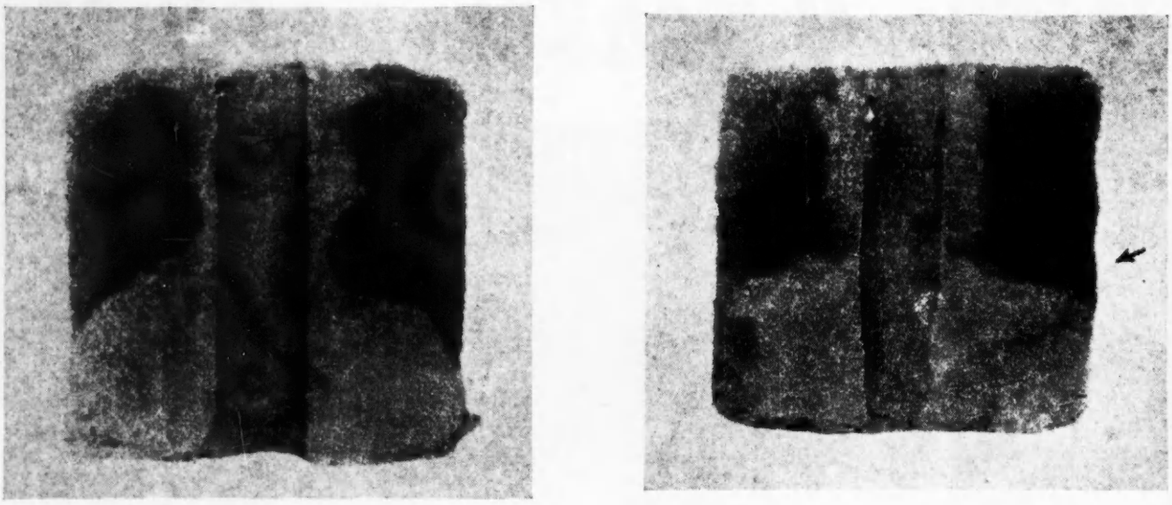

A B

FIGURE 3

Cross-section of cores of sand showing water "cones." (A) Low pressure, slow production in fine-grained sand (140-200 screen). Production largely water. (B) High pressure rapid production. Slight increase in per cent of oil. Note that a little oil indicated by dark shade is breaking through cone at spot indicated by arrow.

ter cone was clearly visible in the vertical sections of the cake (Figure 3). It is interesting to note that the water cone was formed regardless of the pressure differentials employed. These experiments show that in laboratory work the rate of production has little to do with the formation of a water cone in very fine sand, and that the encroachment of water around a well is not altogether dependent upon pressure. The water percentage in some fine-grained cores was slightly less at high rates of flow than at low rates (Figure 3, a and b). These differences are due, probably, to capillary action, which is more effective in the area immediately surrounding the well than in the interior of the reservoir, and it is more effective at low differential pressures than at high differential pressures.

The results indicate that water encroachment in artificial fine sand reservoirs cannot be successfully controlled by regulating the rate of production. Accordingly, other methods are needed to reduce the water entering the "well."

Reduction of water production by the use of chemicals has been attempted for many years with some success, but none of the processes have come into general use. The precipitation of silicic acid (water glass) in the water strata by injection of sodium silicate and hydrochloric acid has been tried by Mills[6] and others. Recently silicon tetrachloride and antimony trichloride have been used by Kennedy[7]. Neither of these latter chemicals require the addition of a precipitating agent because they react with the water in the sand to form a heavy precipitate that is designed to seal partially the pores of the reservoir. A number of soaps and similar compounds have been used to precipitate certain constituents of the salt water in order to form insoluble residues to plug the interspaces. Some work has been done on the use of surface tension breakers to cause water "cones" to "drop" to the normal water table.[9]

Our investigation has been along the line of changing adhesive tensions within the reservoir sands rather than causing precipitation of chemicals and sealing the pores. Various chemicals have been added to the water layer in the reservoir of the apparatus previously described. Selection of the best agent to add to the water has been investigated by measuring the surface tensions with a ring tensiometer and interfacial tensions between water and different oils with the apparatus devised by Bartel[10] for this purpose, and by observing the effect of various chemicals on the tension development. A better method appears to be to measure the rate of flow of the variously treated fluids through a cell of known permeability. A change in the adhesive tension between the fluid and sand is indicated by a change in rate of flow.

The chemicals found most satisfactory are those that reduce the surface tension of water and do not mix with oil—namely, the various kinds of soaps, such as laurates, stearates, and oleates of sodium and potassium.

The effect of small amounts of soap solution on the oil-water ratio has been tested in the fluid mixture in the reservoir just described. The average water reduction when the kerosine and fresh water were flowing through fine sand (140-200 screen) was from 75 percent before the treatment to 5 percent after treatment, as indicated in the following table:

	Viscosity (CP) Oil	Water	Permeability (Darcys)	Pressure (Hg)	Fluid Produced cc Oil	Water
Before treatment	1.7	0.95	2.5	5.1	25%	75%
After treatment	1.7	1.05	2.5	5.1	95%	5%

The change is noticeable almost immediately upon adding the soap solution, and a constant ratio is reached within 30 minutes. It is not due to the de-

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pression of the water cone in the sand. The sand cakes were sliced immediately after the flow was stopped, and a large water cone plainly discernible around the "well" reached within 1 cm. of the top of the sand. The amount of water reduction was too large to be explained by water-cone depression. Even if the cone were depressed to the original water table, the theoretical water production through the sand should be approximately 60 percent of the total fluid and not 5 percent.

A better explanation is to be found in the adhesive tension of a soap film to the surface of the sand, which apparently has the effect of reducing the size of the interspaces through which water can flow at ordinary pressures. It is thought that molecules or colloidal particles of soap are adsorbed by the sand. These colloidal particles gradually build up a film about each individual sand grain, a condition that increases the friction in the interspaces through which the water must travel. Since the soap does not mix with the oil, it affects the passageways occupied by the water and not those filled with oil. In other words, it retards the flow of the water and not that of the oil. No precipitation takes place within the sand, for the water entering and leaving it is perfectly clear. The adsorptive force of silica for water has been discussed by Nutting.[11]

Much more satisfactory results have been obtained with fresh water than with oil-field brines, because most soaps are insoluble in salt water. When East Texas oil field waters were treated with soaps, the reduction of water yield was only 5 percent to 10 percent. The problem in the use of brines in these experiments is to find appropriate chemicals that are soluble in the various oil-field salt waters.

This paper merely presents the preliminary results of a series of laboratory investigations. The work is being continued, and it is hoped additional information regarding the behavior of fluid mixtures in fine sands will be obtained. More knowledge of the flowing properties of the various fluids and of their application to oil-water ratios may later present a more satisfactory solution of the oil-field water problem and thus become of economic interest. It is not claimed that the methods employed in our laboratory are directly applicable in field conditions.

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Capacity Pumping of Oil Wells

By S. B. SARGENT, JR.

THERE is a balance between the amount of production that a pumping well is capable of flowing and the amount of fluid that a pump is capable of producing. Methods are outlined to control the pumping installation so as to obtain the maximum flow from a well.

The factors controlling the amount of fluid which can be obtained from a well are the plunger speed, operating fluid level of the well and the intake pressure on the pump.

This paper was presented before the Spring Meeting of the Southwestern District, American Petroleum Institute Division of Production, at Dallas, Texas, April 1 and 2. The statements and opinions expressed are those of the author, and should not be construed as official action of the Institute or of this journal.

WHILE it is realized that there have been several outstanding investigations of this problem, it is felt that the time is opportune to review the field, and to correlate the work of earlier investigators with more recent investigations by the author and other investigators with whom he has had the privilege of associating.

In pumping oil wells the use of some form of a reciprocating pump is customary. The essential parts of the pump comprise an intake valve, a moving piston or cylinder in conjunction with a stationary cylinder, or piston, and an exhaust valve.

Elementary consideration of the problem discloses two primary conditions. First, to get the oil through the intake valve, and second, to get it through the exhaust valve. As oil is almost universally produced with certain quantities of gas and water, these fluids enter the problem simultaneously as factors in the problem of producing oil.

Establishing the Well's Potential Production

Various methods of estimating a well's capacity to produce before it is placed on the pump are in vogue. All operators have some sort of previous history of the well before it is ready to put on the pump. First, there is some idea of what other wells in the vicinity have been doing. Again many operators run swabbing tests to determine what the well is capable of producing. Where the well has been flowing, the daily production may have been plotted, and the well's capacity determined from the daily production curve.

The use of recording depth pressure gauges has become common to evaluate the productivity index of a well. Several types of these gauges have been developed by various operators. These instruments are widely used and most of them are either described in the literature, or their description is available to the public from the manufacturers thereof.

The value of the depth pressures obtained by the use of these instruments is based on the conception that as the fluid level in the well is lowered, the pressure at the sand face is lowered and the flow from the sand increases. Thus, when the well is standing under static conditions there is no flow from the sand into the well. As the fluid in the well is lowered, the flow starts from the sand into the well. At some optimum fluid level, or pressure, the well will have a maximum rate of flow. By determining this fluid level by a recording pressure gauge in the hole, we are aided in designing our pumping installation so as to obtain the maximum production. A comparison of the rates of flow, bottom hole pressures and gas-oil ratios also allows the determination of the optimum rate of flow with respect to the conservation of bottom hole energy. Again this data serves to measure the density of the fluid to be pumped, and thus provides for special consideration of the particular fluid in the pump installation. The depth pressure gauges are run on a wire line before the well is put on the pump, and may be run on the pump after the pumping installation has been made.

The fluid level work has been performed in California recently by the means of an instrument known as a depthograph operating on the principle of recording the time required for a low frequency pressure wave to travel from the surface to the top of the fluid and to be reflected back. The instrument has also been used very successfully to determine the density of the fluid.

After the well's capacity has been determined, it then becomes necessary to design a pumping installation which is capable of producing the desired amount of fluid.

A Method of Calculating Plunger Displacement

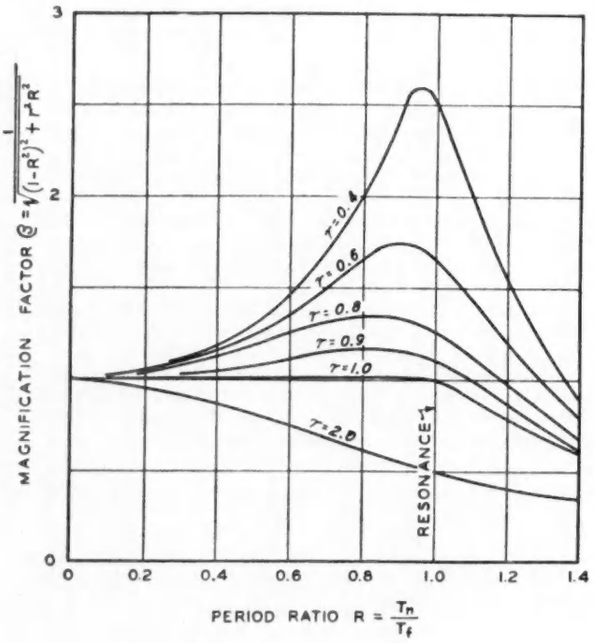
Early investigators of this problem simply calculated the plunger load and subtracted from the surface stroke the stretch which would be occasioned by the static load applied to the given string of rods. It became evident early in the study of pump action that this method was not applicable, as many wells

were pumping satisfactorily when the stroke calculated on this basis was zero.

Attempts to analyze this problem by actually measuring the rod loads led to the development of surface dynamometers by Marsh, Lake, Brett, Kemmler, Westinghouse Manufacturing and others. The results of their work are scattered through the literature. Probably the first correction fatcor applied to this problem was outlined by C. J. Coberly,[1] who developed the following relation:

$$e - e' = \frac{1.93\ (LN)^2}{1000}$$

W. E. Gilbert in his work "An Oil Well Pump Dynagraph"[2] has shown from subsurface measure-



MAGNIFICATION FACTOR VS. PERIOD RATIO CURVES FOR DIFFERENT VALUES OF DAMPING

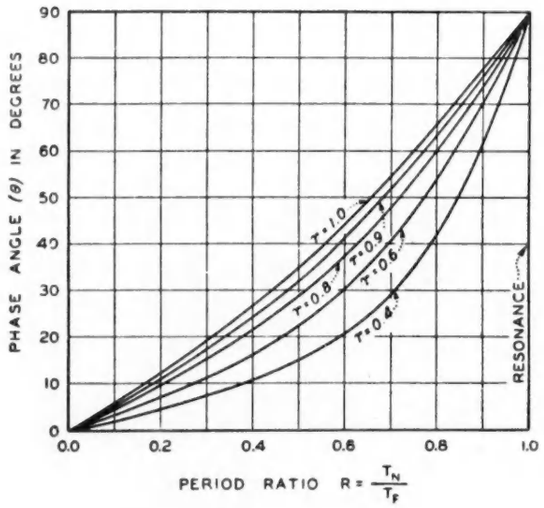
FIGURE 1

ments of the plunger stroke that this acceleration factor varies from well to well, and that the magnitude of this variation may be as much as four, and a variation as much as two is not uncommon. Mr. Coberly in his discussion of Mr. Gilbert's paper suggested an average value of 2.50.

R. W. Rieniets, in an unpublished thesis, has developed an expression for the plunger stroke, which in our experience delineates the plunger travel more accurately and is applicable over a wider range. His work is based on the theory outlined in Timoshenko's text, "Vibration Problems in Engineering," which was called to the attention of the oil industry by J. W. Kendrick of the Sullivan Machinery Company in the Fort Worth Meeting (1936) of the A.I.M.E. It can be shown from the above and other texts on the subject that in a system consisting of a walking beam, sucker rods, and a plunger, that the forces involved in the system are of a vibratory nature, and that the force exerted by the walking beam is transferred to the lower end of the string, changed in form by a magnification factor "β." "β" then becomes the ratio between the value of a static force and the value of the same force under the conditions of constraint imposed. Its numerical value is given by the expression:

$$\text{Where: } \beta = \frac{1}{\sqrt{(1 - \frac{T_1}{T_2})^2 + r^2 \frac{T_1^2}{T_2^2}}}$$

T_1 = the time of the period of natural vibration.
T_2 = the time of the period of a forced vibration.
r = the coefficient of damping, and is dependent on the nature of the fluid being pumped.



CURVES OF PHASE ANGLE VS PERIOD RATIO FOR DIFFERENT VALUES OF DAMPING (τ)

FIGURE 2

Numerically these factors have the following values for our purpose:

$$T_1 = \frac{4 \times \text{depth in feet}}{17{,}000}$$

$$T_2 = \frac{60}{\text{S.P.M.}}$$

r = .4 for wells producing pipe line oil
= .8 for wells up to a 50% water cut
= 2.0 for wells having 90% water cut or over.

The selection of the proper value for "r" is at present a matter of judgment, and while it is felt that eventually it will be possible to evaluate it in terms of the viscosity of the fluid, due to the fact that a value of .8 is applicable to over 75 percent of the wells measured with the subsurface dynagraph, it is felt that more experience must be gained to establish "r" for any particular fluid. Figure 1.

As a rule, in the case of an oil well pumping string, the general treatment of the subject can be described by the mathematics of harmonics. It can

[1]Mid-year A. P. I. meeting, Dallas, Texas, June, 1931, in discussion of H. N. Marsh's paper: "High Volumetric Efficiency in Oil Well Pumping and its Practical Results"; Production Bulletin 207, Page 60.

[2]17th Annual A. P. I. Meeting, Chicago, Ill., Nov. 1936; Drilling and Production Practice, 1936.

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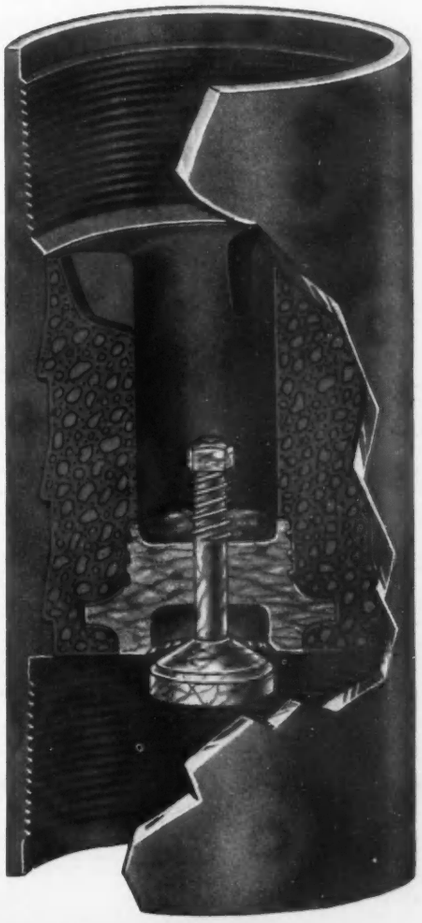

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be shown by these methods that the motion of the plunger is out of phase with the motion of the walking beam by a phase angle θ, Figure 2, and that

$$\text{Tan}\,\theta = r\frac{T_1}{T_2}\Big/1-\frac{T_1^2}{T_2^2}$$

Rieniets' formula assumes the following form:

$$S_p = \frac{Q}{K}\beta + S_s \quad \text{Cos}\ \theta - 2\frac{W_r}{K}$$

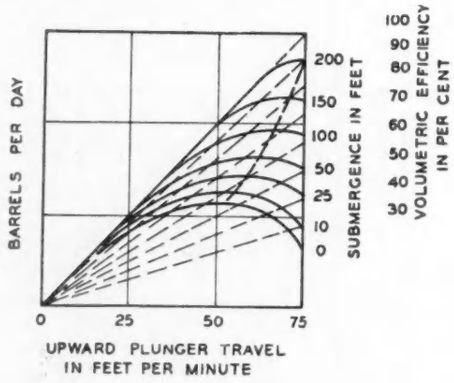
S_p = Pump plunger stroke in inches.
W_r = Weight of rod string in pounds.
W_f = Weight of fluid on plunger in pounds.
b = The angular velocity. Radians/sec.
s = ½ surface stroke in feet.
g = 32.2 ft. sec².
$\frac{b^2s}{}$ = Impulse factor.

$$Q = 2\left(W_r\frac{b^2s}{g}\right) + W_f\left(1+\frac{b^2s}{g}\right)$$

S_s = Polish rod stroke (inches).

"Q" is defined as the periodically varying force applied to the system. It consists of the force necessary to accelerate the rods, plus the weight of the fluid, plus the force necessary to accelerate the fluid. A short consideration will show that these factors account for the variation in force applied to the system by the walking beam. In short they are the forces transferred on and off the system, and available at varying times to move the plunger.

"K" is a conversion factor from load to stretch



CHARACTERISTICS OF
OIL WELL PLUNGER TYPE PUMP

AFTER DATA BY UREN, COLLINS, & SARGENT
INTERPRETED BY W.E GILBERT

FIGURE 4

and is defined as the force required to stretch the given string of rods one inch.

$$K = \frac{A\,E}{L}$$

or for a combination string

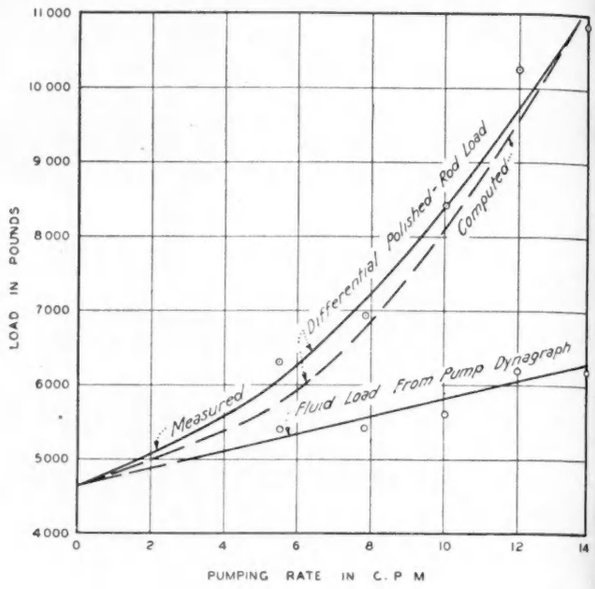
$$K = \frac{E}{\frac{L_1}{A_1}+\frac{L_2}{A_2}+\frac{L_3}{A_3}}$$

in which

A = the average area of rods
E = 30 x 10⁶
L = the length of rods in inches.
θ and β are as defined in the preceding context.

Selection of Proper Operating Speed

Before offering an actual example, attention is called to the fact that displacement per se is not the only problem involved. The amount of fluid which the pump is capable of pumping, is governed by the submergence of the pump, and the speed with which



LOAD CHANGES WITH PUMPING SPEED

FIGURE 3

it operates. Figure 3 and Figure 4 illustrate data obtained from "The Effect of Submergence on Oil Well Pump Efficiency," by Uren, Collins and Sargent.[3]

Work performed with subsurface pressure gauges previously mentioned indicates that the maximum flow from a well is obtained with zero pressure at the sand face to provide the maximum differential pressure from the sand to the well. This would predicate an upward plunger travel of not over fifty-five feet per minute to obtain the maximum production when operating under the conditions as illustrated in Figure 4. Otherwise, the well will never be pumped down, and a higher operating fluid level will of necessity be maintained. Thus, a plunger large enough to produce the well's capacity at the optimum speed as determined by the pump design should be chosen. The prevailing practice of lessening rod loads by the use of small diameter pumps and high operating speeds is perhaps the most prevalent cause of the inability to pump a well down and to obtain the potential indicated by the well's productivity index.

Another consideration before making an installation is the desirability of a minimum clearance volume to handle such gas as comes through the tubing. As the importance of clearance volume is predicated on its percentage of the total volume, and as mechanical difficulties place a practical limit on the minimum clearance volume in a pump, as long a

[3]Sixth Annual Meeting, Los Angeles, Calif., January, 1926; A. P. I. Bul. 27, Vol. VII, April, 1926; reprinted in A. P. I. Production Bulletin No. 27-A, Page 94.

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TABLE NO. 1—PUMP DATA

Oil String Size			Safe Inserted Joint Tubing O.D.	Tubing Size	TUBING TYPE			ROD TYPE			
								Cup or Composite		Machined Working Barrel	
O.D.	W.T.	I.D.			Pump O.D.	Plunger O.D.	*Pump Constant	Plunger O.D.	*Pump Constant	Plunger O.D.	*Pump Constant
8⅝".....	36	7.775	5½"	4 "	5"	3¾"	1.6061	3½"	1.425	3.250 3.000	1.2300 1.0488
7⅝".....	33	6.765	4¾"	3"	4"	2¾"	0.8808	2½"	0.7279	2.250 2.000	0.5895 0.4659
7".....	28	6.214	4¾"	3"	4"	2¾"	0.8808	2½"	0.7279	2.250 2.000	0.5895 0.4695
6⅝".....	28	5.791	3½"	2½"	3½"	2¼"	0.5895	2"	0.4659	1.750 1.500	0.3500 0.2622
5½".....	20	4.778	2⅞"	2"‡	2⅞"	1¾"	0.3566	1½"	0.2622	1.250 1.000	0.1821 0.1165
†4¾".....	16	4.082	2⅜"	1½"	2⅜"	1½"	0.2622	1¼"	0.1821	1.000 0.750	0.1165 0.0605

After E. K. Parks in wells "Economic Selection of Size of Oil Strings in California," A.P.I. Production Division, Pacific Coast District Meeting, Los Angeles, April 13, 1937. (Reproduced herein by permission of the author.)
The 1½" Pumps listed above, at various times are run in 3" liners.
* Theoretical displacement in barrels per day, equals Pump Constant x Stroke (inches) x S.P.M.
‡ Plain tubing, although upset, is sometimes run.
† 2" Plain tubing with corresponding sizes of pumps are sometimes run, although it may cause pump trouble due to gas not flowing through the constricted annular space and hence having to be handled by the pump. It is extremely difficult to obtain adequate draw down due to this condition.

stroke as is consistent with practical limits is desirable.

Illustrative Example

To sum up the problem in general before showing a typical example, it is desirable to have a pump sufficiently large to pump the well's production at a speed of fifty-five feet of upward plunger travel per minute or less, with as long a stroke as is consistent with jack limitations. The plunger size is of course often limited by loads imposed on sucker rods and jacks, or by casing sizes. Table No. 1 shows the recommended sizes of tubing to use in various sizes of casing. Bearing these factors in mind, let us now consider the problem of a 4000-foot well with 8⅝-inch casing capable of producing 1,000 B/D:

$$\frac{\text{Barrels per day}}{\text{Plunger travel in inches per minute}} = \text{Pump constant}$$

The optimum upward plunger travel is 55 feet per minute, or 660 inches per minute.

$$\frac{1000}{660} = 1.5 \text{ pump constant.}$$

The nearest commercial sized plunger to this value is a 4-inch pump having a plunger of 3¾-inch diamter. (Table 1).

An important factor in multiplying rod stress is the ratio of the natural period of the rods to the forced period, therefore as long a stroke will be chosen as is available to lessen the number of strokes per minute, in this case, approximately five 11-foot S.P.M.: fluid density is assumed as .35 lbs. 1 sq. in./ft. depth:

$$W_f = \text{Area of plunger} \times \text{depth} \times .35$$
$$= 11.045 \times 4000 \times .35 = 15{,}500 \text{ lbs.}$$

The impulse factor $\frac{b^2s}{g}$ then becomes

$$\frac{b^2s}{g} = \frac{2 \times 5.5^2}{60} \times \frac{5.5}{32.2} = .0565$$

The actual dynamic load due to fluid weight and fluid acceleration then becomes:

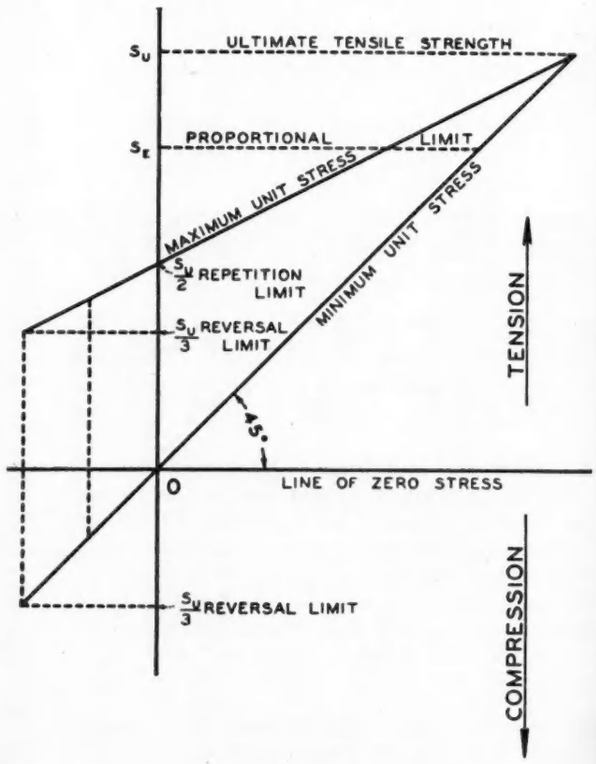
$$15{,}500 \times (1 + .0565) = 16{,}360.$$

As it is not desired to stress the rods beyond the proportional elastic limit of 30,000 pounds per square inch, the value of 25,000 pounds per square inch will be used:

$$\frac{\text{Load}}{25{,}000} = \text{Area}$$

As rods must carry their own weight, an area capable of carrying a load of 25,000 pounds will be chosen for the first step in the graduation of the rod string. This area becomes *one inch.* A 1⅛-inch round has an area of .9940 square inches. This is chosen as the first size in this tapered string.

The rods then are capable of carrying (25,000—

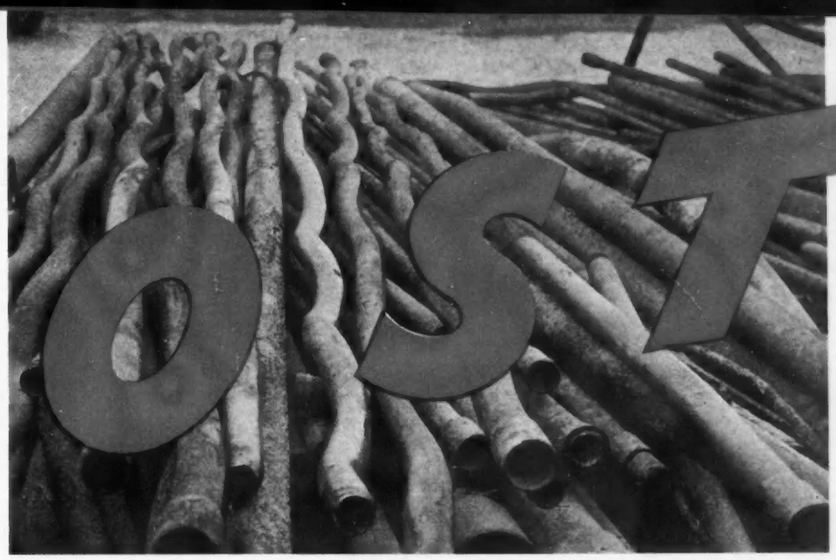


GOODMAN DIAGRAM

AFTER MAURER & WHITHEY "STRENGTH OF MATERIALS"

FIGURE 5

LOST!



Enough Money to Equip a lot of wells with

BJ TUBING CATCHERS

THIS "cork-screwed" tubing cost enough money to buy dozens of BJ Tubing Catchers, and even then the operator was lucky! When you think of the possibility of permanently losing a producing well, the money lost would pay for all the tubing catchers you ever will need for complete protection of every well!

THE NEW SHORTYPE "C" CATCHER

. . . with an overall length of only 32 inches, and a price lower than any real tubing protection ever before offered, is the answer to the problem of crooked holes and wells of average depth, also where price is a vital factor.

THE FAMOUS SURESTOP CATCHER

. . . is proving today in countless thousands of wells that it is the ultimate in tubing insurance, regardless of depth. And the BJ Anchoring Method—adapted to either of these catchers—enables the stationary, anchored pump to take a full stroke and develop maximum efficiency.

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Send me all information on BJ Tubing Catchers, and the BJ Anchoring Method.

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Position.....
Company.....
P. O. or Street.....
City.....
State.....

16,360) pounds of their own weight. One and one-eighths inch rods would weigh about 3.5 pounds per foot.

$$\frac{25{,}000 - 16{,}360}{3.5 \times 1.0565} = 2300 \text{ ft. of } 1\tfrac{1}{8}\text{-in. rods.}$$

The next step would be 1¼-inch rods weighing about 4 pounds per foot. The area of a 1¼-inch rod is 1.2272 square inches. The rods would therefore carry 1.227 x 25,000=31,000 pounds.

$$\frac{31{,}000 - 25{,}000}{4 \times 1.0565} = 1400 \text{ ft. of } 1\tfrac{1}{4}\text{-in. rods.}$$

1⅜-inch rods weigh 4.7 pounds per foot. They are capable of supporting 1.485x25,000 pounds = 37,000 pounds.

$$\frac{37{,}000 - 31{,}000}{4.7 \times 1.0565} = 1200 \text{ of } 1\tfrac{3}{8}\text{-in. rods.}$$

The string would then be composed of 2300 feet of 1⅛-inch, 1400 feet of 1¼-inch and 300 feet of 1⅜-inch rods. The maximum rod load would be

$$(15{,}500 \text{ plus } 2{,}300 \times 3.5 \text{ plus } 1400 \times 4 \text{ plus } 300 \times 4.7) \times 1.0565 = 32{,}200 \text{ lbs.}$$

The maximum differential load is given by the expression:

$$(2\,W_r)\,\frac{(b^2s)}{g} + \frac{(1 + b^2s)\,(W_r)}{g}$$

$$2 \times 15{,}000 \times .0565 + 1.0565 \times 15{,}500 = 19{,}810 \text{ lbs.}$$

The accompanying Goodman diagram[4], Figure 5, based on information in repeated and reversed stresses indicates no special steel should be required for the rods.

Calculating the plunger stroke with the Rieniets formula:

$W_r = 15{,}000$ lbs.
$W_f = 15{,}500$ lbs.

$$T_1 = \frac{4 \times 4000}{17{,}000} = .942 \text{ sec./cycle}$$

$$T_2 = \frac{60}{5.5} = 10.9 \text{ sec./cycle}$$

$$T_1/T_2 = \frac{.942}{10.9} = .0863$$

Using a value of .8 for r from the curves, we find $\theta = 3°$ and $\beta = 1$. For all practical purposes—

$\cos \theta = 1.$

$$\frac{b^2s}{g} = .0565$$

$K = 690$ lbs.

$$Q = 2\,(15{,}000)\,(.0565) + (1.0565)\,(15{,}500) = 18{,}190.$$

$$S_p = \frac{18190}{690} + 132 \times \cos\theta - \frac{2 \times 15{,}500}{690}$$

$26 + 132 - 45 = 113$ inches.

Operating at 5.5 S.P.M. results in 5.5 x 113 = 662 inches of plunger travel per minute as against 680 inches, the optimum speed. The displacement becomes 995 barrels per day. This, of course, is an ideal installation and would almost pump down a well which had a static pressure of 500 pounds and a productivity index of two barrels per day per pound of draw down.

As this equipment is not available, a 3-inch installation will be designed. This installation will not draw the fluid level down completely because of the pump characteristics as shown in Table 1. We will, therefore, operate at some speed higher than 55 feet per minute, or at approximately 100 feet per minute.

Then:

W_f = plunger area × depth × .35,
For a 2¾-in. diameter plunger.
$W_f = 8300$

A speed of 1200 inches per minute with a 10-foot stroke is about 10 S.P.M. In order to allow a little leeway, the rod string is designed for 12 S.P.M., the top speed recommended for the present long-stroke jacks. The impulse factor then becomes for 12 10-foot S.P.M.:

$$\frac{b^2s}{g} = \frac{(12 \times 2)^2}{(60)} \times \frac{5}{32.2} = .246$$

and,

$$8300 \times 1.246 = 10{,}400 \text{ lbs. dynamic loading.}$$

The natural selection for this load would be a 7/8-inch rod for the start of the tapered string. A 7/8-inch rod on the basis of the previous allowable stress can carry 15,000 pounds.

$$\frac{15{,}000 - 10{,}400}{2.26 \times 1.246} = 1650 \text{ ft of } \tfrac{7}{8}\text{-in. rods.}$$

A 1-inch rod is capable of carrying to the nearest 500 pounds a load of 20,000 pounds.

$$\frac{20{,}000 - 15{,}000}{2.8 \times 1.246} = 1400 \text{ ft. of 1-in. rods.}$$

A 1⅛-inch rod can carry 25,000 pounds.

$$\frac{25{,}000 - 20{,}000}{3.5 \times 1.246} = 1150 \text{ ft. of } 1\tfrac{1}{8}\text{-in. rods.}$$

The string will, therefore, be composed of 1650 feet of 7/8-inch, 1400 feet of 1-inch and 950 feet of 1⅛-inch rods.

The plunger stroke by the Rieniets[5] formula is calculated as follows:

$W_r = 12{,}900$ lbs.
$W_f = 8{,}300$ lbs.
$T_1 = .942$ sec/cycle

$$T_2 = \frac{60}{12} = 5 \text{ sec/cycle}$$

$T_1/T_2 = 1.88$
For $r = .8$, Z is eight degrees
$\cos \theta = .99027$
$\beta = 1.02$

$$Q = 2(12{,}900)\,(.246) + (8300)\,(1.246) = 16{,}700 \text{ lbs.}$$

$K = 560$ lbs. per inch of stretch

$$S_p = \frac{(16{,}700)}{560}\,1.02 + 120 \times .99 - \frac{2 \times 8300}{560} =$$

$30 + 119 - 30 = 119$ inches
119×12 S.P.M. $= 1432$ in. per min.
$1432 \times .8808 = 1250$ B/D displacement

At this point, if the equipment were available, a decision would be made on the basis of the productivity index. If this factor were high enough so that the well would produce approximately this amount with an operating fluid level of about 400 feet, or 150 pounds, the pumping installation would function. This value of 400 feet is obtained by extrapolating the curves in Figure 4. The curves become asymptotic to a line paralleling the diagonal line representing 100 percent pump efficiency and intersects the abscissa at about 1200 inches per minute at 400 feet.

Thus, if the static fluid level were 500 pounds the draw down would be 350 pounds. Hence, if the productivity index were about 3.5 barrels per day per

[4]From Maurer and Withey, "Strength of Materials."

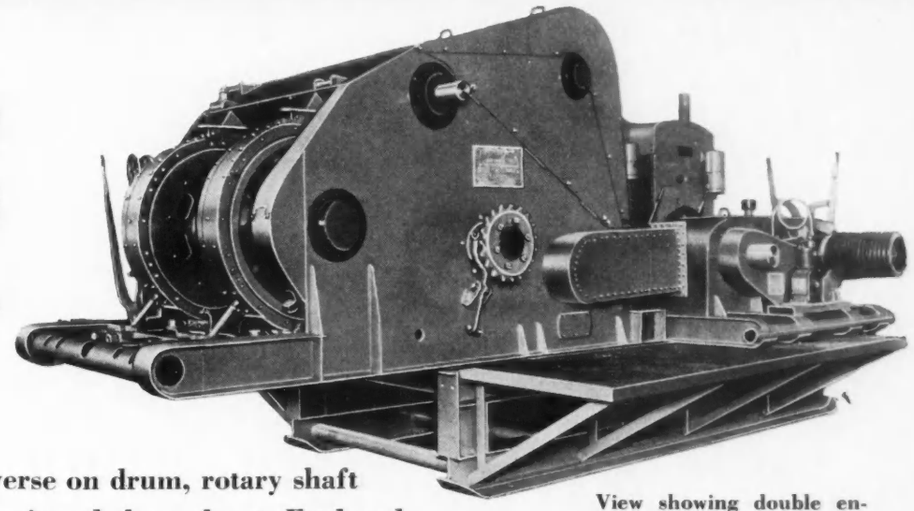
AN 8-SPEED PORTABLE RIG

FOR 6,000-FOOT DRILLING

With or Without Sand Reel

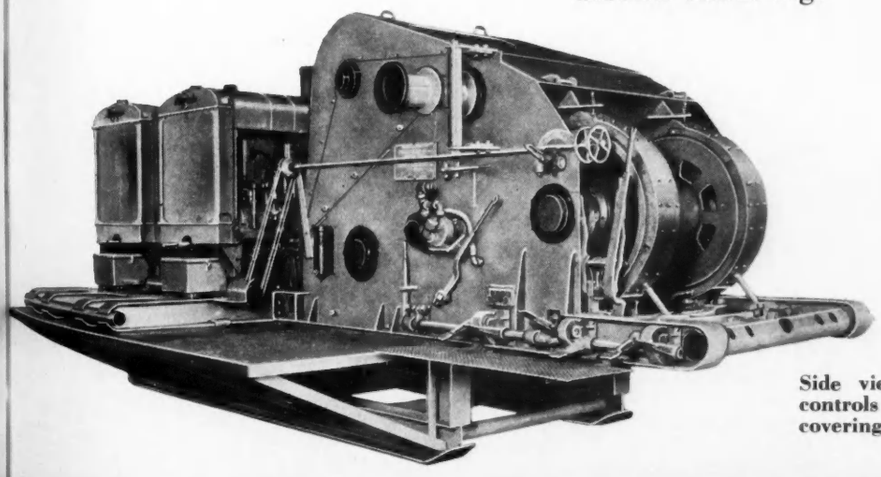
A FEW OF THE MANY FEATURES OF THIS NEW PORTABLE RIG,

MODEL R-876-8



View showing double engine drive, rotary sprocket, air compressor and pump drive.

Eight speeds forward, six speeds reverse on drum, rotary shaft and sand reel. Roller bearing equipped throughout. Enclosed sand reel (optional). Self-energizing brakes are water-cooled by circulation in shoes attached to bands. Double compound leverage gives 90% brake area contact. Dual drive (gasoline, natural gas or Diesel fuel engines) which can be compounded into draw works or pumps. Air controlled engine clutches. Air compressor supplied with rig. Pump is provided to furnish force-feed lubrication to all chains, bearings, sprockets and shafts. Heavy-duty friction clutches on drum and rotary shafts. Substructure, allowing either one or two pumps to be set on ground level, fits any height derrick and provides walkway around entire rig.



Side view showing the accessible controls at driller's position. Drum covering removed to show water-cooled brakes.

Complete specifications will be sent upon request

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EXCLUSIVE PACIFIC COAST DISTRIBUTORS WAGNER-MOREHOUSE, INC., LOS ANGELES, CALIFORNIA

pound of draw down, a pumping production of about 1200 barrels per day could be expected.

Attention is called to the fact that curves represented in Figure 4 are for a particular pump, and a particular type of crude.

At this point we shall repeat the calculations for slightly different conditions on an actual installation, putting them in a stereotyped form and following them with dynagraph cards on the installation.

Data:

Well depth ..... 4300 ft.
Production desired ..... 1000 B/D
Rods available ..... 1-in — ⅞-in. — ¾-in.

THREE INCH INSTALLATION

Fluid weight .....0.35 lbs./ft. depth/in.^{2}
Pumping depth .....4300 ft.
Plunger diameter .....2.750 inches
Plunger area .....5.93 in.^{2}
Area of rod ..... .601 in.^{2}
Fluid load on plunger .....5.33 in.^{2}
Net area of plunger.....$5.33 \times 0.35 \times 4300 = 8050$ lbs.

Installation No. 1

10-foot stroke, 11 strokes per minute.

To determine the acceleration factor in order to determine the stress, simple harmonic motion is assumed,

$$F = W + \frac{W}{g} a, \text{ Newton's second law}$$

For harmonic motion the maximum acceleration $= \frac{b^2 s}{g}$

where b is the angular velocity and s is the radius of the crank, or ½ the walking beam stroke, then

$$F = W + \frac{W}{g} b^2 s$$

$$= W\left(1 + \frac{1}{g} b^2 s\right)$$

$$b = \frac{2}{N} \pi$$

N = number of seconds required to make one stroke
= 5.45 sec. at 11 S.P.M.

$$b = \frac{2\pi}{5.45} = 1.15 \text{ Radians/sec.}$$

$b^2 = 1.325$
s = 5 ft. for a 10 foot stroke

$$F = W\left(1 + \frac{1.325 \times S}{32.2}\right) = 1.206\ W$$

Live Fluid Load

Dead load × acceleration factor
$8050 \times 1.20 = 9650$ lbs.

WORKING STRESS

Using a working stress of 27,000 lbs./in.^{2} recommended by B. H. Robinson[6] on a statistical basis as giving satisfactory rod service at Santa Fe Springs; this stress incidentally is about 12,000 lbs./in.^{2} less than stresses commonly used (17,000 lb. dynamometer load on ¾-inch rods).

Length of Rod Used:

$$\text{Permissible Load} = \frac{\text{Live load of fluid and rods}}{\text{Weight of rod/ft.} \times \text{acceleration factor}}$$

	¾ rods;		Area .4418 in.^{2}
$\frac{.4418 \times 27000 - 9650}{1.65 \times 1.20} =$		Feet 1158	No. of rods 38

	⅞ rods		Area .601 in.^{2}
$\frac{.601 \times 27000 - 11950}{2.26 \times 1.20} =$		Feet 1590	No. of rods 53
	1 in. rods		Area .7854 in.^{2}
$\frac{.7854 \times 27000 - 16220}{2.8 \times 1.20} =$		1470	49
TOTAL		4218′	140 rods

Stroke

The equation for stroke at the plunger is given by the expression:

$$S_p = \frac{Q}{K} + S_s \cos\theta - \frac{2W_f}{K}$$

S_p = plunger stroke
Q = disturbing force on polish rod
K = force required to stretch the rods 1 inch
S_s = polish rod stroke
W_f = weight of fluid
θ = phase angle between polish rod movement and plunger movement
R = ratio of natural period of rods to disturbing force

$$\theta = \tan^{1} \frac{r R}{1 - R^2}$$

r = damping coefficient
r = .8 (from dynamometer experience)
β = Magnification factor = 1.03 from Fig. 1

$$R = \frac{T_1}{T_2}$$

$$T_1 = \frac{4 L}{a}$$

L = depth in feet
a = speed of sound in steel = 17,000

$$T^2 = \frac{60}{\text{S.P.M.}}$$

$$Q = 2 \times 9630 \times .206 + 8050 \times 1.206 = 13,700$$

$$S_p = \frac{(13,700)}{346} \times 1.03 + .9890 \times 120 - 2\,\frac{(1850)}{346}$$

$S_p = 113$

Production

B/D displacement = C × S.P.M. × S_p
C for 2.75 dia. plunger = .8808
B/D = .8808 × 11 × 113 = 1095 B/D
Pump displacement = 1095 B/D

2½ Inch Installation

Installation No. 2—10 foot stroke, 11 S.P.M.

The impulse factor is identical with the preceding calculation, therefore:

F = 1.206 W.

Fluid Load on Plunger

Plunger area × depth × .35
$3.9761 \times 4300 \times 35 = 6000$ lbs.

Live Fluid Load

Dead load × Impulse Factor
$6000 \times 1.206 = 7200$ lbs.

Length of rod used:

Permissible load = (live load of fluid and rods below point of stress)

¾ rods Area .4418 Weight/ft. 1.65 lbs.

$$\frac{4418 \times 27000 - 7200}{1.65 \times 1.2} = 2300 \text{ ft of ¾ rods.}$$

⅞ rods Area .601 Weight/ft. 2.26 lbs.

$$\frac{601 \times 27,000 - 11,950}{3.26 \times 1.20} = 1600 \text{ ft of ⅞ rods.}$$

1-in rods Area .7854 Weight/ft. 2.8 lbs.

$$\frac{.7854 \times 27,000 - 16,200}{2.8 \times 1.20} = 1470 \text{ ft of 1-in. rods.}$$

The rod string, therefore, is composed of 2300 feet

[5]MMS: R. W. Rieniets, Sargent Engineering Corp., Los Angeles, Calif. (Reproduced by permission of the author).

[6]B. H. Robinson: "Deep Well Pumping in the Santa Fe Springs Field"; in "Improvements and Trends in Production Practice", by W. W. Scott; Twelfth Annual A. P. I. Meeting, Chicago, Ill., November, 1931; Production Bulletin No. 208, Page 175.

APRIL-1917

Fig. 1740 Gaso Duplex Piston Timken Bearing Power Pump. 54 to 250 Bbls.

April 6, 1917 . . . war . . . parades . . . draft boards . . . liberty loan drives. A long time ago? Yes, but many a Gaso Pump placed in service in 1917 is still delivering a full quota of service—striking proof that EXTRA strength pays EXTRA dividends in the form of EXTRA service. . . . Gaso Pump & Burner Mfg. Co., Tulsa, Okla. Export Office: 149 Broadway, New York.

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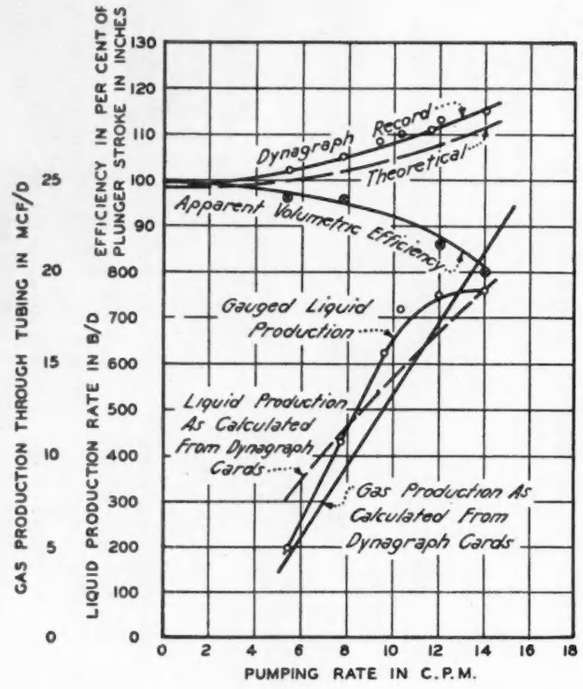
GASO PUMPS
for every oil industry need


GAS PRODUCTION THROUGH TUBING IN MCF/D
LIQUID PRODUCTION RATE IN B/D
EFFICIENCY IN PER CENT OF PLUNGER STROKE IN INCHES
Dynagraph Record
Theoretical
Apparent Volumetric Efficiency
Gauged Liquid Production
Liquid Production As Calculated From Dynagraph Cards
Gas Production As Calculated From Dynagraph Cards
PUMPING RATE IN C.P.M.

PUMP DATA

FIGURE 6

¾ rods 1600 feet of 7/8 rods and 400 feet of 1 inch.

$W_r = 8540$ lbs.

$K = 300$

From the preceding calculations:

$r = .8$

$\frac{b^2 s}{g} = .206$

$\cos \Theta = .9890$

$\beta = 1.03$

$Q = (2 \times 8540 \times .206) + 6000 \times 1.206 = 10{,}750$

$$S_p = \frac{(10{,}750)}{300} \times 1.03 + 120 \times .989 - \frac{2 \times 7200}{300} = 108''$$

Production

B/D Displacement = $.5895 \times 11 \times 108$, or 700 bbl.

Figures 6, 7, 8 and 9 represent data obtained from subsurface dynagraph records under discussion in the previous context and are evaluated by methods outlined by W. E. Gilbert.[7]

The well has a productivity index of about four barrels per day per pound of draw down. It had an indicated capacity of about 2000 barrels per day, a static pressure of about 550 pounds per square inch and an operating fluid level of about 400 pounds per square inch. The well produces about 600 barrels per day with this draw down leaving a potential production of about 1400 barrels per day more.

The well was equipped with a 2¼ x 20 foot bottom support tubing type pump, operating with a ten foot surface stroke.

The dynagraph record and the theoretical curves check both as to type and magnitude of stroke. The gauged liquid production curve was obtained by taking two hour runs at the speed in question. It does not check well with the production as measured by the dynagraph nor the subsequent production obtained from the well. Subsequent production obtained from the well more closely approximates the dynagraph record. In fact, the discrepancies between the last two curves can be explained on the basis of known leakage. A study of the discrepancies between these two curves lead to changes averaging a net increase of fifty barrels per day.

[7]Op. Cit.

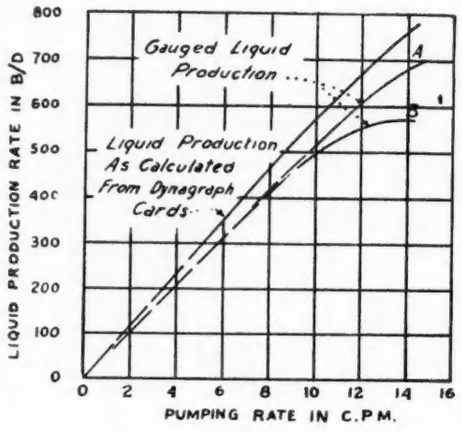
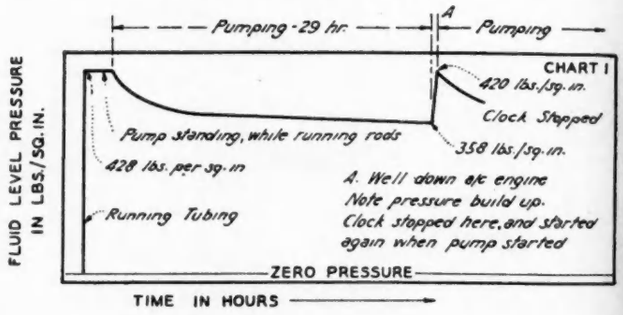
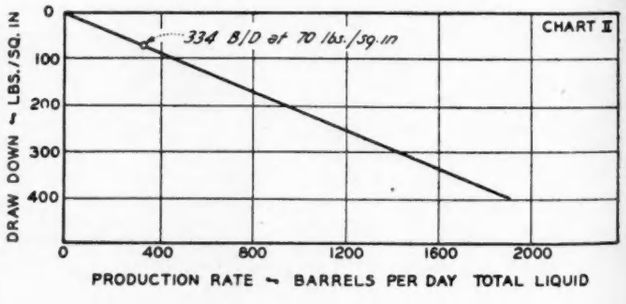

LIQUID PRODUCTION RATE IN B/D
Gauged Liquid Production
Liquid Production As Calculated From Dynagraph Cards
A
PUMPING RATE IN C.P.M.

FIGURE 7

The liquid production curves and apparent volumetric efficiency curves in general fit in with predictions which were made from curves shown in Figure 4. Treating the data by the methods used in Figure 4, this well installation is capable of a max-



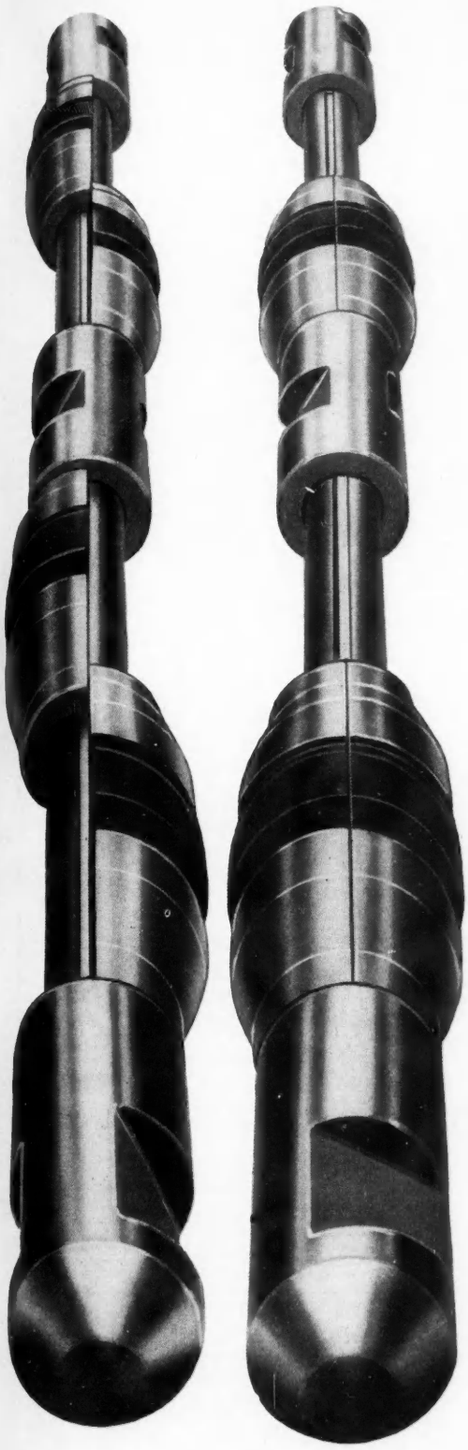
BOTTOM-HOLE PRESSURE RECORD



WELL CAPACITY CURVE EXPRESSED IN TERMS OF DRAW DOWN

BOTTOM-HOLE PRESSURE DATA

FIGURE 8



The left hand illustration above shows the Mission Valveless Swab as it falls in the tubing ... with one-half of each swab rubber raised above the other to allow for fluid passage.

The right hand illustration shows the swab on the up stroke with split rubbers side by side in swabbing position.

28 minutes AGAINST 2 HOURS

at RODESSA

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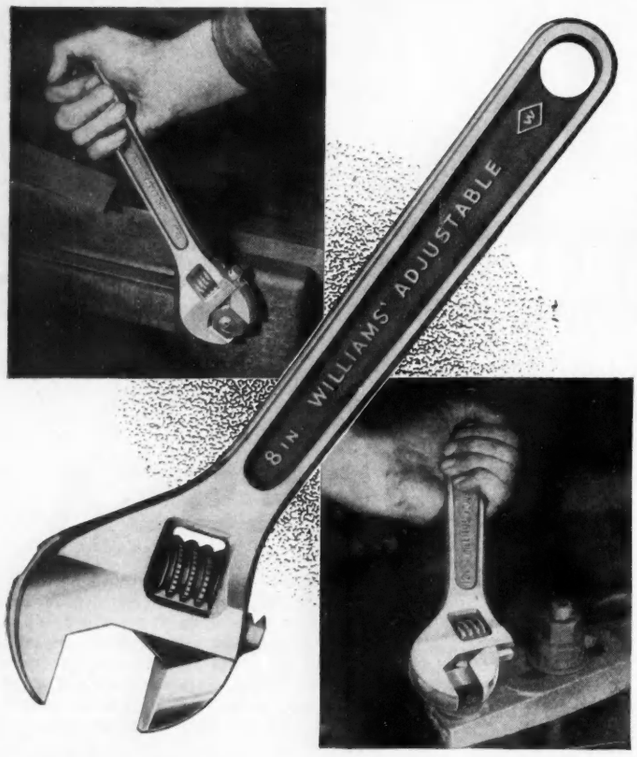

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SUPERIOR DROP-FORGED TOOLS

imum production of about 750 barrels per day at the optimum plunger speed of about 125 feet of upward plunger travel per minute. The operating fluid level will be about 350 pounds per square inch.

The conclusions to be drawn from this paper are:

1. The plunger speed is a controlling factor in the amount of production which may be obtained from an oil well.

2. There are methods available to determine the optimum pumping installation for any well.

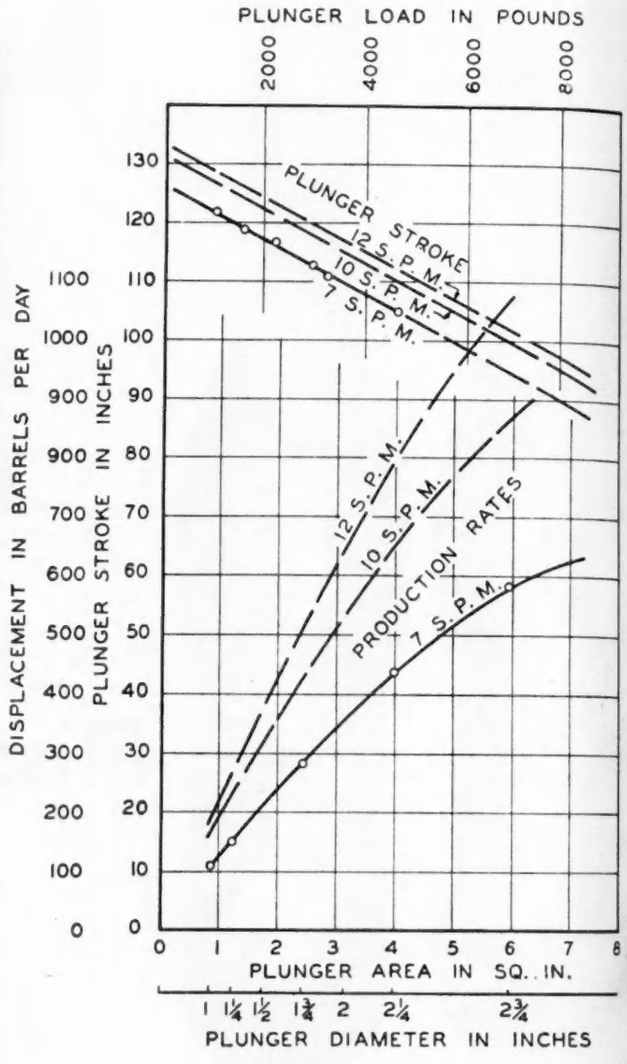

FIGURE 9

3. The underlying present day pumping problems can no longer be treated in an elementary manner.

4. The mathematical theory involved can be explained by mathematics, supposedly common knowledge to all engineers.

5. The necessity of a more thorough understanding is self-evident, in view of common knowledge of a maximum production of 500 barrels per day with a rod pump and 3000 barrels per day by other methods in some wells.

6. Within the limitations of casing sizes, it is possible to design pumping equipment capable of producing the capacity of most wells.

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Practical Ideas

ENGINEERS OFFER SPECIFIC REMEDIES FOR DIFFICULTIES

[*Continued from page 16*]

at a minimum. In many places boilers are operated at too low a percentage of their actual capacity for overall economic operation, principally because of inefficient burners and lack of draft. This is a problem belonging mostly to the operator; however, manufacturers are striving to improve such conditions and promote better understanding of their importance.

Too Much Weight in Boilers

"The problem of boiler rating should be given more consideration since in certain cases it has been somewhat responsible for retarding improvements in boiler design, and in this way perhaps has been quite costly to the industry. There is undoubtedly more unnecessary weight being carried around in the average boiler than in any other one unit of the drilling rig. In many cases operators are paying a premium for high A.P.I. rating and getting nothing but weight in return."

Kitchel pointed out that superheated steam has been found by test to have several advantages over saturated steam. However, its development, with perhaps the exception of the separately-fired superheater, is practically at a standstill because of a few difficulties, most of which are not at all inherent with it.

The most important difficulty experienced with steam that has been superheated has been in providing sufficient lubrication to the pistons and valves of the engine and pumps. Continuing, the speaker stated, "While (solution of) the problem of lubrication has been greatly improved upon in the past few years, it has still not reached the stage of perfection. The force feed lubricators of today are still not considered to be entirely reliable and trouble free for oil field service, and the hydrostatic lubricator does not supply a varying quantity of lubricant in proportion to the need and is not entirely suitable for use with superheated steam."

The matter of developing a suitable portable-type condenser is being worked on by certain operators with some success, and is worthy of more consideration since it would eliminate several undesirable features of steam rigs, Kitchel said.

★ Use completion method best suited to conditions

Three methods of bottom-hole well completion were listed by I. W. Alcorn, Pure Oil Company, Houston, and J. U. Teague, Humble Oil & Refining Company, Houston, in their paper on "Bottom-Hole Well Completion Methods in the Gulf Coast."

After discussing the merits of each method they concluded that, due to the wide variation of sand conditions in the area, it was wise for the operator to determine which method best suited particular conditions. Results obtained in the field indicate that cementation of producing sand has a definite bearing on the size of screen openings to be used, they stated.

The three methods listed by Alcorn and Teague were as follows: 1. The oil string is set and cemented through the producing horizon and then gun perforated opposite the section from which it is desired to produce. Screen may or may not be set. 2. The oil string is set and cemented on top of the producing section and screen or slotted pipe with blank liner and packer are set opposite the section to be produced. This method is the one commonly used. 3. Screen is run on the oil string, with a full-hole cementing device above the screen, which permits the casing to be cemented after the screen has been washed on the outside to some degree.

One Method's Use Growing

Alcorn and Teague presented statistics to show that the first mentioned method is gaining in favor. A factor that lends itself to successful completion by this method, they declared, consists in having a sand high in saturation, porosity and permeability. If this is true, the potential and allowable may be produced with a low differential pressure, or pressure drop, through the perforations. The method also lends itself to economical full-hole cementing. Excellent coring information, good control of the gas-oil ratio and salt water encroachment were other advantages listed by the authors for this method. The success of the method depends upon successful cementing and perforating.

Because of its increasing use in the Gulf Coast "Method 1" was given considerable attention by Alcorn and Teague. Method 2, although still the most common, has several disadvantages, and Method 3 so far has not come into general use.

"The subject of bottom-hole well completion methods is, by its nature, highly controversial, calling no doubt for different methods to satisfy specific requirements, not only of certain areas, but also of individual wells," they concluded. "Due to the large number of unknown and variable factors, the operator should appear justified in going to considerable trouble in determining as nearly as possible the conditions with which he is confronted."

★ Soap solution found to reduce water production

F. B. Plummer, J. C. Hunter, Jr., and E. G. Timmerman, of the University of Texas, reviewed briefly the factors affecting the proportions of oil and water produced in wells, described experiments being carried out to test the proportionate yield of water and oil in fine-grained sands, and explained how the addition of certain chemicals could reduce the flow of water. Their paper "Flow of Mixtures of Oil and Water Through Sand" is presented in full elsewhere in this issue of THE OIL WEEKLY.

In their laboratory tests they have found that the addition of a soap solution to fresh water reduces the proportion of water produced approximately 70 percent. The same solution when added to salt water brines reduces the percent of water only about 10 percent. Messrs. Plummer, Hunter and Timmerman concluded that the soap solution produces a thin film over the surface of the sand grains which reduces the flow of water. Since the soap solution does not mix with the oil it does not affect the production of oil. The lower result obtained in salt water, in the opinion of the authors, is due to the inability of the soap to dissolve in oil-field brines.

They made no claims that the methods used in the laboratory were applicable to field conditions, but expressed the thought that the experiments may possibly lead to an explanation of certain salt water production problems.

★ Methods for determining well's producing capacity

"Capacity of Pumping Oil Wells," was the topic of a paper by S. B. Sargent, Jr., Sargent Engineering Corporation, Huntington Park, California, in which he pointed out that there is a balance between the amount of production a pumping well is capable of flowing and the amount of fluid that a pump is capable of producing. Sargent outlined the methods for controlling the pumping installation so as to procure the maximum flow from a well.

Several important investigations on this problem are underway, and he reviewed the work and correlated earlier discussions. The factors controlling the amount of fluid obtainable from a well are the plunger speed, operating fluid level of the well and the intake pressure on the pump.

The conclusions to be drawn from Sargent's paper, which is presented in full elsewhere in this issue, are as follows:

1. The plunger speed is a controlling factor in the amount of production which may be obtained from an oil well.

2. There are methods available to determine the optimum pumping installation for any well.

3. The underlying present day pumping problems can no longer be treated in an elementary manner.

4. The mathematical theory involved can be explained by mathematics supposedly common knowledge to all engineers.

5. The necessity of more thorough understanding is self-evident, in view of common knowledge of maximum production of 500 barrels per day with a rod pump and 3000 barrels per day by other methods in some wells.

6. Within the limitations of casing sizes, it is possible to design pumping equipment capable of producing the capacity of most wells.

MEN IN THE INDUSTRY'S NEWS

R. OGARRIO, vice president of The Texas Company, New York, presided over the annual meeting of the producing committee of The Texas Company in Houston the past week. Other officials that attended the meeting were: R. F. Baker, assistant to the vice president and chief geologist of the company; F. C. Sealey, formerly of Houston and now production manager of The Texas Company, California; A. C. Hunter, New York, assistant to the manager of the producing department; H. A. Stewart, division manager in charge of the Rocky Mountain division, Denver; R. C. Stewart, division manager of the Louisiana-Arkansas district, Shreveport; J. L. McMahon, division manager, in charge of the West Texas-New Mexico division, Fort Worth; E. R. Filley, in charge of the Oklahoma-Kansas division, Tulsa; L. E. Barrows, manager of the production department, Houston; J. A. Bermingham, division manager of the Southwest Texas division, Houston, and L. A. Scholl, chief of the geophysical division, Houston.

R. D. MONTGOMERY's resignation as a member at large on the Central Committee of California Oil Producers from the Coastal District was accepted by the committee, and R. R. Boyd of the Richfield Oil Company was elected to succeed him. Members at large are appointed by the committee.

E. V. WHITWELL was placed in charge of the geological division of the exploration department of the Carter Oil Company at Tulsa March 27. Whitwell had formerly been manager of exploration for Standard Oil Company of Louisiana, and before that was in the Tulsa office of Carter Oil Company. He replaces D. C. Nufer, resigned, who will go into business for himself.

DR. A. B. BRYAN, former professor of physics at Rice Institute, Houston, Texas, was placed in charge of the geophysical division of the Carter Oil Company March 27. Bryan, who held the same position with Standard Oil Company of Louisiana, will have G. E. Wagoner as his assistant. Bryan was with Carter Oil Company in Tulsa some years ago. He replaces Stuart Sherar, resigned.

DR. F. M. KANNENSTINE, of Rosaire and Kannenstine, Houston, is now operating his laboratory for the manufacture of geophysical instruments independently, under the name of The Kannenstine Laboratories. Dr. Kannenstine originated numerous new features and improvements in the seismograph during his former connection as director of research with the Geophysical Research Corporation at Bloomfield, New Jersey.

T. E. WARD, New York, president Oilfield Equipment Company, was enroute Cuba March 26.

FREDERICK G. CLAPP, consulting geologist of New York, who was absent the greater part of 1936 in western Asia where he has made numerous explorations during the past few years, will continue his explorations during 1937. Aside from other reported activities, he has been conducting explorations in new areas, notably in the plains of Afghanistan beyond the Hindu Push. His friends can always reach him through the New York office.

W. C. PETERSON was re-elected president and managing director of Vulcan Oils, Limited, when shareholders held their annual meeting last week. Other members of the directorate are Dr. G. M. Carson, vice president; A. J. Flood, secretary-treasurer; Dr. H. P. Barker, R. L. Elves and D. C. Jones.

Edits Geophysics Journal

M. M. SLOTNICK

Two degrees in mathematics, M.A. and Ph.D. from Harvard in 1925 and 1926, respectively, following a B.S. from that institution in 1922,—teaching fellowships in Harvard in 1922-25 and 1928-29, National Research Fellow in mathematics at Princeton in 1928-29, plus a Harvard Research Fellowship at Hamburg University in Germany and two years of teaching math at Grinnell College, to say nothing of his present occupation as supervisor of the interpretation group of Humble Oil & Refining Company's geophysics department, should render M. M. Slotnick of Houston well fitted for editorship of the journal of the Society of Exploration Geophysicists, a position to which he was recently elected in Los Angles.

T. J. DONOGHUE, vice president of The Texas Company, and J. C. Colligan, Dallas, pipe line superintendent of The Texas Pipe Line Company, two of the original employes of The Texas Company, will be among the guests at a meeting of old time Texas Company employes who will celebrate the thirty-fifth anniversary of The Texas Company's charter with a dinner at the Houston Club in Houston on the evening of April 7. W. S. S. Rodgers, president of The Texas Company, will also be a guest of honor.

DR. W. C. ILLING, London, England, professor of geology, Royal College of London, is making a tour of the oil fields in the Southwest in behalf of several oil interests after attending the recent Los Angeles meeting of the American Association of Petroleum Geologists. He was a guest speaker at the Dallas Petroleum Geologists' weekly luncheon on March 31.

DR. E. E. ROSAIRE, formerly connected with Independent Exploration Company, Houston, has opened an office in the Esperson Building, Houston, and will engage in experimental geophysics and geochemistry.

JOSEPH A. KORNFELD, geologist, and Victor Mount, land man for Barnett Petroleum Corporation, Dallas, have been temporarily located at Pecos, Texas, in connection with the company's purchase of drilling blocks in the Delaware Basin section of West Texas.

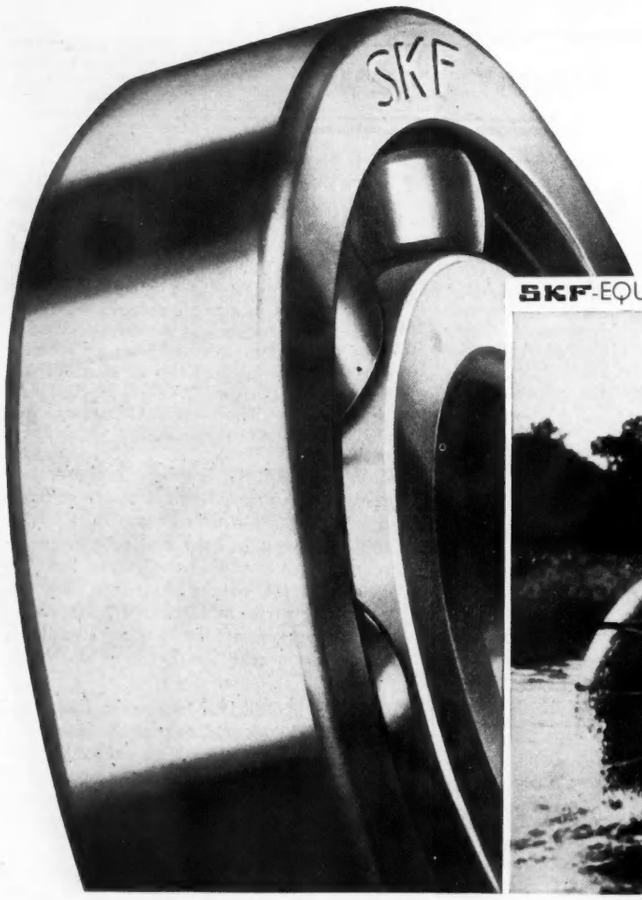
DOUGLAS WILLIAMS, scout for Humble Oil & Refining Company, Corpus Christi, left Houston for John Hopkins Hospital, Baltimore, Maryland, April 2, where he will receive treatments for an illness.

ARTHUR C. SIMMONS, geologist of Bradford, Pennsylvania, discussed the history and development of the Bradford-Allegany field before members of the Men's Club of Eldred, Pennsylvania, last week.

DIED:

RAYMOND H. CHERRY, sales manager of the wire rope division of Wickwire Spencer Steel Company, died at his home in Westfield, New Jersey, on March 20 after a protracted illness of several weeks. In 1909, Cherry entered the employ of American Steel & Wire Company where he remained until enlisting for military service in France from March, 1918.

BERT R. EMRICK, JR., son of Bert R. Emrick, who was for several years general superintendent for Burmah Oil Company, was killed in an automobile accident March 31 while returning to Houston from Richmond, Texas.



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Strength Adds Hope

GASOLINE HIKE ENCOURAGES IDEA CRUDE PRICE SOON TO ADVANCE

HOPEFULNESS currently pervades the oil industry's markets, because of stricter control of crude production, and prices already have shown the influence of the brighter general outlook. Gasoline tank-car and tank-wagon prices forged higher last week, and the crude market became increasingly firm, with payments of premiums for crude becoming more numerous in various districts, including East Texas.

It is evident that there are some expectations of further increases in prices of refined products and possibly of crude oil.

The strength of the refined oil markets currently is further stimulating the hopes of producers for a moderate increase in crude oil postings this spring.

The market is particularly strong for Pennsylvania grade crudes, and an early increase in prices of those oils is being predicted.

Late last week the demand for light fuel oils was receding, although it previously had been revived considerably by the temporary return of winter weather throughout much of the country. During the colder weather there was some emergency buying of the burning oils.

Heavy fuel oils, meanwhile, have continued in steady demand, as industrial concerns and railroads have been active buyers. The supplies of those oils were reported limited in some areas.

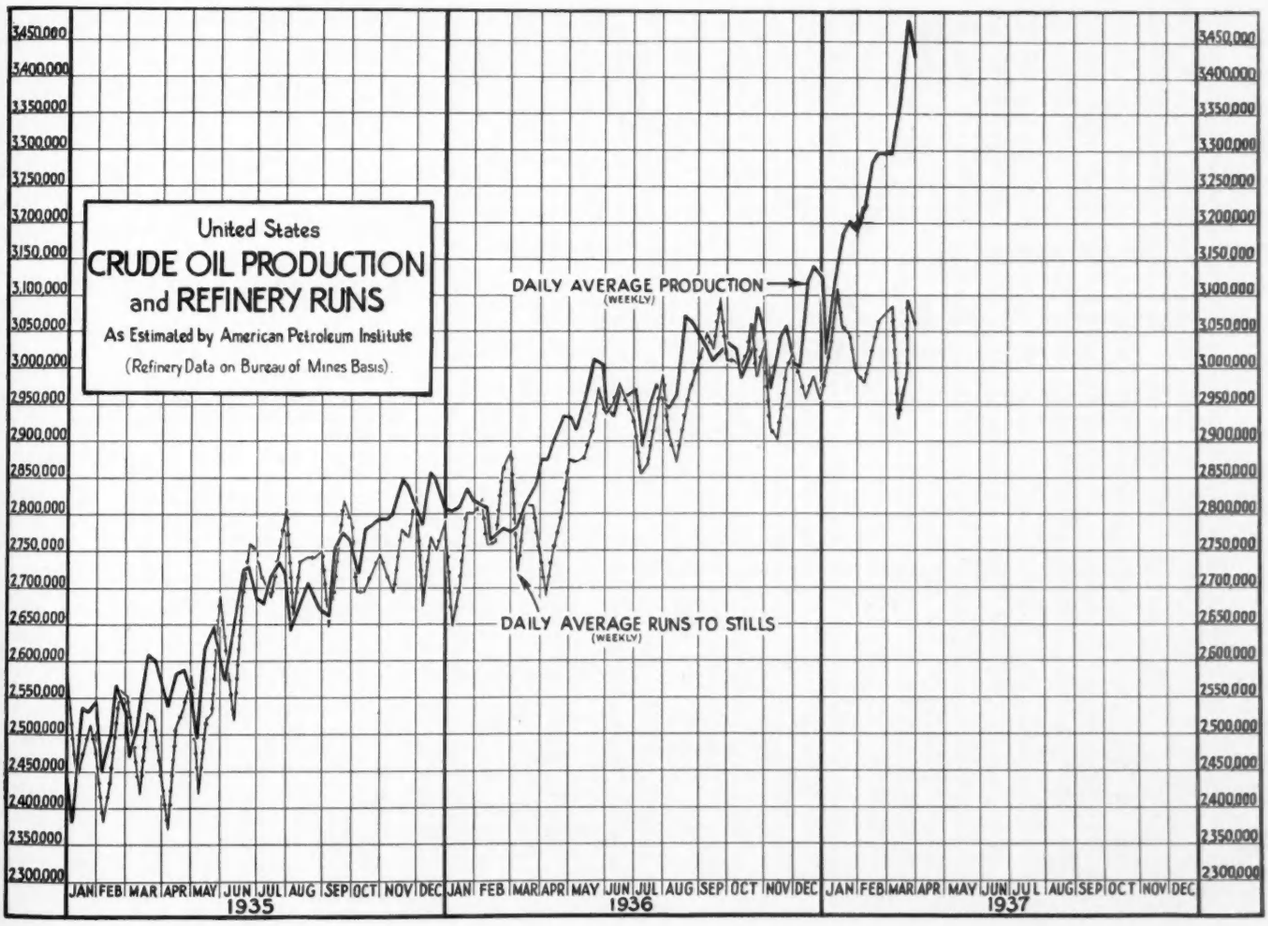
Kerosene prices have remained unchanged, and the demand has been steady.

The upward trend of gasoline prices last week indicated that there is very little anxiety over the present all-time record stocks of gasoline. Although the inventories are about 12 percent larger than at this time last year, such an increase is largely justified by the gain that has occurred in gasoline consumption. The Bureau of Mines has estimated that the gasoline demand this month will be 10 percent higher than that of April last year. The latest figure available on the gasoline stocks is the total of 83,538,000 barrels reported by the American Petroleum Institute for March 27. In the week ended on that date the stocks were increased nearly 2,000,000 barrels, to another new peak. A year previously, the total gasoline stock aggregated 74,155,000 barrels.

Gasoline Prices Up

The tank car prices of gasoline at Oklahoma refineries were generally one eighth cent higher late last week than a week before. Chicago market prices were up similarly on some grades.

Effective April 1, Socony-Vacuum Oil Company advanced dealer tank-wagon and jobber and consumer tank-car prices of all grades of gasoline one-half cent generally through New England and the northeastern portion of New York state, which includes the Albany district. Prices at



Hartford and Middletown, Connecticut, were advanced at the same time one cent a gallon. No changes were made in metropolitan New York City or in western New York state.

Crude Situation Better

The better outlook regarding crude production has resulted from the stricter allowables that have been prescribed for April by the leading producting states. It is indicated that additions to crude storage will be stopped during the month.

The crude stocks have been steadily increasing for about two months, the latest report of the Bureau of Mines showing another gain of nearly a million barrels in the week ended March 20, to a new total of 291,555,000 barrels. In the 8 weeks from January 23 to March 20, the crude stocks were increased 6,344,000 barrels each week showing some addition to the storage.

The additions were particularly heavy in March, when the state allowables were materially above the Bureau of Mines estimates of market requirements.

For April, however, the state allowables are close to the federal allocations, and it is indicated that there will be a virtual restoration of the balance between crude production and the market demand.

CRUDE PRICES

Complete table of prices paid for crude oil at the well in principal fields is found on page 96. Hereafter this schedule will appear only in the first issue of each month except when changes are announced.

Mid-Continent Prices

Late last week U. S. motor gasoline prices f.o.b. Oklahoma refineries, up one eighth cent above the previous week, ranged from 5 to 5⅛ cents a gallon for 62 octane and below; from 5⅜ to 5½ cents for 63 to 67 octane; and from 6 to 6⅛ cents for the 68 to 70 octane material.

Corresponding prices in the Chicago market were: 4⅞ to 5⅛ cents, 5⅛ to 5⅜ cents, and 5¾ to 6 cents.

In East Texas the usual 60-62 octane, 400 end point gasoline on the market was priced at 5 cents a gallon, whereas one week previously the price paid in some instances had been as low as 4⅞ cents.

Kerosene and Fuel

Kerosene prices at the Oklahoma refineries continued last week within a range of 4⅛ to 4⅜ cents a gallon for the 41-43 water white grade and from 4¼ to 4½ cents for the 42-44 water white grade. Those minimum prices applied generally as the market prices in the Chicago district.

In the Chicago market the No. 1 white burning oils were priced at 3⅞ cents a gallon, and the No. 1 straw at 3¾ cents. The No. 2 straw was 3⅜ to 3¾ cents, and the No. 2 dark was 3⅜ to 3⅝ cents. No. 3 oils were 3¼ to 3⅜ cents a gallon.

For industrial use the No. 4 heavy oils were priced at $1.07½ to $1.12 a barrel, the No. 5 grade at 80 to 90 cents, and the No. 6 at 75 to 80 cents.

CALIFORNIA QUOTA

Los Angeles.—The Central Committee of California Oil Producers on March 25 established a new crude oil production allowable of 600,983 barrels a day for the state, effective April 1. The new plans also provide for the addition of a necessary amount to take care of new wells completed during March, but not to exceed a grand total of 603,983 barrels. The old allowable was 551,000 barrels a day, but daily production has been averaging close to 590,000 barrels.

ALLOWABLE RAISED

Austin.—The Texas Railroad Commission has raised the allowable for the Plymouth field, San Patricio County, to 13,060 barrels daily effective April 1. This will mean an allowable of 110 barrels per well.

The order issued in March provided for an allowable of 100 barrels daily per well, or 11,880 barrels the entire field.

The commission has been advised that the additional oil was needed to supply a demand for a foreign market and that the oil was not available from other fields.

LET LINE CONTRACT

Mission, Texas.—Contract has been awarded by Standard Oil Company of Texas, Dallas, for immediate construction of a 15-mile 3-inch crude line to extend from Alta Mesa field, Brooks County, to a tank car rack site at Rachal. The line will have a capacity of 3000 barrels daily. Crude will be shipped by rail from Rachal to Coastal Refineries, Incorporated's refinery at Port Isabel, Texas.

Weekly Trends of United States Production and Stocks

(Figures American Petroleum Institute, except crude stocks, Bureau of Mines.)

WEEK ENDED—	Crude Oil Production (Barrels Daily)	Crude Runs to Stills (Barrels Daily)	Crude Oil Stocks (Barrels)	Gasoline Stocks (Barrels)	Gas & Fuel Oil Stocks (Barrels)
January 23, 1937	3,205,150	3,055,000	285,211,000	68,180,000	103,441,000
January 30	3,194,050	2,995,000	285,384,000	69,540,000	102,078,000
February 6	3,220,750	2,980,000	286,116,000	70,535,000	101,136,000
February 13	3,286,050	3,020,000	286,158,000	73,585,000	100,735,000
February 20	3,295,950	3,065,000	287,574,000	74,798,000	99,391,000
February 27	3,296,100	3,085,000	288,121,000	78,786,000	99,534,000
March 6	3,298,800	2,930,000	289,611,000	80,102,000	99,115,000
March 13	3,372,850	2,985,000	290,613,000	81,236,000	98,964,000
March 20	3,448,150	3,095,000	291,555,000	81,623,000	97,287,000
March 27	3,431,300	3,060,000	.....	83,538,000	96,591,000
March 28, 1936	2,876,200	2,765,000	311,169,000	73,012,000	96,009,000

Summary of Wells Completed in the United States Week Ending April 3, 1937

	Completions	Oil Wells	Gas Wells	Failures	Initial Production	Total, 1937	Total this Date 1936
Alabama	....	....	....	....	.....	1	2
Arkansas	5	....	....	5	.....	18	26
California	32	28	....	4	14,638	309	253
Colorado	....	....	....	....	.....	5	4
Florida	....	....	....	....	.....	....	....
Illinois	....	....	....	....	.....	11	4
Indiana	....	....	....	....	.....	33	60
Kansas	37	32	....	5	35,500	532	357
Kentucky	....	....	....	....	.....	51	39
Louisiana	13	8	....	5	6,397	174	238
Michigan	....	....	....	....	.....	194	175
Mississippi	....	....	....	....	.....	5	1
Montana	2	2	....	....	59	19	21
Nebraska	....	....	....	....	.....	....	....
New Mexico	16	16	....	....	28,907	180	118
New York	....	....	....	....	.....	3	....
Ohio	24	6	11	7	142	426	526
Oklahoma	50	31	3	16	24,955	714	657
Pennsylvania	4	....	3	1	.....	39	....
Texas	244	194	7	43	256,806	3,443	2,921
Utah	....	....	....	....	.....	....	....
West Virginia	14	3	10	1	27	220	158
Wyoming	4	2	....	2	961	27	14
Total this week	445	322	34	89	368,392	6,404	5,564
Total last week	464	343	26	95	430,919	....	....
Total this year	6,404	4,280	599	1,525	5,459,264	....	....

Comparison of Permits Granted For New Wells

STATE	Week Ending April 3	Total this Mo.	Total this Year	Total this Date Last Year	1936 Year Total
Arkansas	7	7	42	21	103
California	31	31	343	215	1,054
Louisiana	6	6	218	288	1,107
Kansas	64	64	577	400	1,873
Michigan	....	....	208	163	762
Oklahoma	60	60	671	664	2,594
Texas	320	320	4,412	3,388	15,582
Total	488	488	6,471	5,139	23,075

Production Drops

U. S. DAILY AVERAGE DOWN TO 3,418,850 BARRELS

UNITED STATES crude oil production during the week ended April 3 was 16,075 barrels a day lower than in the previous week, averaging 3,418,850 barrels daily. That was 259,850 barrels more than the daily average recommended for March by the Bureau of Mines.

This decline in output of the country's wells was encouraging, since crude production has been somewhat greater than market requirements for two months, resulting in additions to storage.

Three States Responsible

The decrease from the previous week reflected declines in Texas, California, and Louisiana, which more than offset small increases in Oklahoma, Kansas, and New Mexico.

Texas last week averaged 1,397,300 barrels daily, or 13,200 barrels a day less than in the previous week, reflecting the fact that lower allowables became effective in the latter part of the week. For the coming week a further sharp decline for Texas is indicated, in full reflection of the reduced allowables for April. The Texas output of last week was 140,700 barrels above the Bureau of Mines recommendation for daily output in March, although not that much above the estimate for April.

California last week averaged 585,250 barrels daily, or 6750 barrels a day less than in the previous week, and 14,350 barrels a day more than the federal allocation.

Louisiana showed a decline of 8750 barrels in averaging 241,400 barrels daily last week. That was only 1400 barrels a day more than the federal allocation.

Oklahoma output was up 8200 barrels to 648,725 barrels a day last week, exceeding the federal allocation 58,025 barrels.

Kansas last week averaged 189,175 barrels daily, or 2525 barrels more than in the previous week, and 11,175 barrels a day more than the Bureau of Mines recommendation.

New Mexico output was up 500 barrels, to 103,400 barrels a day, or 15,200 barrels daily more than the federal allocation.

United States Crude Oil Production

Estimates Compiled by The OIL WEEKLY

DISTRICT OR STATE	Bureau of Mines Recommendation (Daily in Mar.)	ACTUAL PRODUCTION: BARRELS DAILY FOR WEEK ENDING April 3	March 27
TEXAS—			
Texas Panhandle	.....	77,800	76,600
North Texas	.....	68,200	67,800
West Central Texas	.....	33,100	32,600
West Texas	.....	207,800	208,100
East Central Texas	.....	121,100	124,400
East Texas Field	.....	455,800	454,800
South Texas	.....	227,200	234,300
Texas Gulf Coast	.....	206,300	211,900
Total Texas	1,256,600	1,397,300	1,410,500
OKLAHOMA—			
Oklahoma City	.....	164,400	150,800
Seminole Area	.....	131,500	134,500
Crescent	.....	14,550	15,625
Lucien	.....	13,225	13,500
Fitts	.....	88,375	89,700
Edmund	.....	23,750	26,450
Moore	.....	13,700	14,675
Others	.....	199,225	195,275
Total Oklahoma	590,700	648,725	640,525
KANSAS—			
Ritz-Canton	.....	5,400	5,450
Chase	.....	10,275	9,175
Hollow-Nikkel	.....	4,075	4,125
Sedgwick	.....	4,700	4,825
Burrton	.....	16,375	16,225
Lorraine	.....	5,350	5,000
Russell County	.....	28,375	24,550
Silica	.....	17,800	19,025
Others	.....	96,825	98,275
Total Kansas	178,000	189,175	186,650
LOUISIANA—			
North Louisiana	.....	65,300	70,950
South Louisiana	.....	176,100	179,200
Total Louisiana	240,000	241,400	250,150
ARKANSAS	28,500	27,500	27,200
CALIFORNIA—			
Long Beach	.....	60,100	61,000
Santa Fe Springs	.....	44,200	44,500
Huntington Beach	.....	35,600	37,000
Dominguez	.....	24,400	24,500
Inglewood	.....	12,200	12,000
Ventura Avenue	.....	32,700	33,500
Seal Beach	.....	9,100	9,000
Midway-Sunset	.....	65,900	65,000
Elwood	.....	9,400	9,500
Kettleman Hills	.....	76,050	79,000
Mountain View	.....	20,300	21,000
Playa del Rey	.....	9,300	9,500
Others	.....	186,000	186,500
Total California	570,900	585,250	592,000
MOUNTAIN STATES—			
Wyoming	42,200	51,200	52,800
Montana	14,660	15,800	15,700
Colorado	4,300	4,600	4,600
Total Rocky Mountain States	61,100	71,600	73,100
NEW MEXICO	88,200	103,400	102,900
EASTERN STATES	114,700	115,400	113,700
MICHIGAN	30,300	39,100	38,200
Total United States	3,159,000	3,418,850	3,434,925

UNION PLANS

Drive to start with meet at Houston on April 5

Washington, D. C.—Officials of the Committee for Industrial Organization this week completed their plans for a drive on the oil industry, to be initiated with a meeting between the executive council of the International Association of Oil Field, Gas Well and Refinery Workers, affiliated with the CIO, and the newly-formed Petroleum Workers Organizing Committee at Houston, April 5, which will be followed by a mass meeting of oil workers in that city April 8.

At the April 5 meeting, it was said by CIO officials, plans will be mapped out to proceed with the organization of the 1,000,000 workers employed in the producing, refining and distributing branches of the industry. The main purpose of the drive, it was said, will be to win union recognition and the right of collective bargaining for all workers in the industry.

CRUDE OIL PRICE SCHEDULES

(Figures Revised to April 2, 1937)

MID-CONTINENT GRAVITY SCALE PRICES (Posted January 28, 1937)

(Some fields of Mid-Continent have flat price postings, and are shown separately.)

Gravity	Okla.-Kans.	North La.-Ark.	Rodessa, La.-Tex.	North & W. Cent. Tex.	East Cent. Tex.	Gray Co. Tex.	Carson Hutchinson Co. Tex.	[1]Conroe, Tex. Type	West Tex.-N. Mex.	[2]Gulf Coast (Tex.-La.)	[3]Some La. Gulf Areas	[4]Anahuac, Tex. Type	[5]Refugio, Tex. Type	[6]Mirando, Tex. Type
17–17.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	*$0.90	.....	.....	.....	.....
18–18.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.92	.....	.....	.....	.....
19–19.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.94	.....	.....	.....	.....
20–20.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.96	*$0.90	.....	*$0.95	*$0.90
21–21.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.98	.93	.....	.98	.93
22–22.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.01	.96	.....	1.01	.96
23–23.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.04	.99	.....	1.04	.99
24–24.9	*$0.98	*$0.90	*$0.93	*$0.88	.....	.....	.....	.....	.....	1.07	1.02	.....	1.07	1.02
25–25.9	1.00	.92	95	.90	.....	.....	.....	.....	*$0.78	1.10	1.05	.....	1.10	1.05
26–26.9	1.02	.94	.97	.92	.....	.....	.....	.....	.80	1.13	1.08	.....	1.13	1.08
27–27.9	1.04	.96	.99	.94	.....	.....	.....	.....	.82	1.15	1.10	.....	1.15	1.10
28–28.9	1.06	.98	1.01	.96	*$1.03	.....	.....	*$1.20	.84	1.17	1.12	.....	1.17	1.12
29–29.9	1.08	1.00	1.03	.98	1.05	.....	.....	1.22	.86	1.19	1.14	.....	1.19	1.14
30–30.9	1.10	1.02	1.05	1.00	1.07	.....	.....	1.24	.88	1.21	1.16	$1.16	1.21	1.16
31–31.9	1.12	1.04	1.07	1.02	1.09	.....	.....	1.26	.90	1.23	1.18	1.18	1.23	1.18
32–32.9	1.14	1.06	1.09	1.04	1.11	.....	.....	1.28	.92	1.25	1.20	1.20	1.25	1.20
33–33.9	1.16	1.08	1.11	1.06	1.13	.....	.....	1.30	.94	1.27	1.22	1.22	1.27	1.22
34–34.9	1.18	1.10	1.13	1.08	1.15	*$0.96	*$0.91	1.32	.96	1.29	1.24	1.24	1.29	1.24
35–35.9	1.20	1.12	1.15	1.10	1.17	.98	.93	1.34	.98	1.31	1.26	1.26	1.31	1.26
36–36.9	1.22	1.14	1.17	1.12	1.19	1.00	.95	1.36	1.00	1.33	1.28	1.28	1.33	1.28
37–37.9	1.24	1.16	1.19	1.14	1.21	1.02	.97	1.38	1.02	1.35	1.30	1.30	1.35	1.30
38–38.9	1.26	1.18	1.21	1.16	1.23	1.04	.99	1.40	1.04	1.37	1.32	1.32	1.37	1.32
39–39.9	1.28	1.20	1.23	1.18	1.25	1.06	1.01	1.42	1.06	1.39	1.34	1.34	1.39	1.34
40 & Above	1.30	1.22	1.25	1.20	1.27	1.08	1.03	1.44	1.08	1.41	1.36	1.36	1.41	1.36

* Minimum price and applies also to purchases of lower gravity.

[1] Conroe, Tomball, Satsuma, Raccoon Bend Deep fields.

[2] Upper Texas Gulf Coast, including Goose Creek, Spindle Top, etc., and some fields of Louisiana Gulf Coast, including Black Bayou, White Castle, Vinton, Hackberry, etc.

[3] Choctaw, Darrow, Lockport, Iowa (Magnolia posting), Cameron Meadows, etc.

[4] Anahuac, Dickinson, Flour Bluff, Turtle Bay.

[5] Lower Texas Gulf Coast, including Refugio, Saxet, etc.

[6] Duval, Jim Hogg, Webb, and Zapata Counties; Heyser, Placedo fields.

Mid-Continent Flat Prices

	Flat Price	Date Posted
Arkansas:		
Smackover	$0.90	1–28–37
Louisiana:		
Garden Island	1.37	1–28–37
Lafitte	1.24	1–28–37
Texas:		
East Texas	1.27	1–28–37
Talco	.73	1–28–37
Livingston, Cleveland	1.27	1–28–37
Hardin	1.15	1–28–37
Van	1.10	1–28–37
Pettus	1.37	1–28–37
Pecos County	.91	1–28–37
Pecos Shallow	.81	1–28–37
Luling	1.00	1–28–37
Lytton Springs	1.12	1–28–37
Salt Flat, Darst Creek, Hilbig, Carroll, Clark, Zoboroski	1.09	1–28–37

Michigan Prices

Central Michigan	$1.42	1–29–37

Middle West Prices

Lima	$1.25	1–28–37
Illinois	1.35	1–28–37
Princeton	1.35	1–28–37
Western Kentucky	1.40	1–28–37

Rocky Mountain States Prices

	Flat Price	Date Posted
Elk Basin	$1.30	1–28–37
Frannie Light	.70	11– 4–36
Frannie Heavy	.62	11– 4–36
Grass Creek Light	1.30	1–28–37
Grass Creek Heavy	.62	11– 4–36
Hamilton Dome	.57	11– 4–36
Big Muddy	1.23	1–28–37
Rock Creek	1.20½	1–28–37
Sunburst	1.20	1–28–37
Lance Creek	.97	1–28–37
Osage	1.08	.....
Cat Creek	1.07	8–25–33
Cut Bank	1.35	6– 3–36
Pondera	1.05	9–29–33
Hogback	1.00	9– 8–33

Pennsylvania Prices

Bradford-National Transit	$2.67	2–24–37
Sw. Pa. Pipe Line	2.42	2–24–37
Eureka Pipe Line	2.37	2–24–37
Buckeye Pipe Line	2.22	2–24–37
Corning Grade	1.32	12–18–36

Canada Prices

Petrolia	$2.10	9– 9–33
Oil Springs	2.17	9– 9–33

Mexico Prices

F.O.B. Tampico; net; U.S. Currency, buyer pays tax	$1.07	.....

Major Price Changes

	Penna. (Nat. Tr.)	Mid.-Cont. (36 Gr.)	Calif. (26 Gr.) †
June 19, 1933	Up 10	Up 19	.....
June 26, 1933	Up 10	.....	Up 9-12
July 6, 1933	Up 13	Up 10	.....
July 17, 1933	Up 15	.....	.....
July 28, 1933	Up 15	.....	.....
August 11, 1933	Up 10	.....	.....
August 24, 1933	.....	Up 10	.....
August 30, 1933	Up 15	.....	.....
September 6, 1933	Up 10	Up 10	Up 15
September 8, 1933	.....	Up 15	.....
May 1, 1934	Up 10	.....	.....
November 6, 1934	Cut 25	.....	.....
December 6, 1934	Cut 25	.....	.....
January 4, 1935	Up 15	.....	.....
February 4, 1935	Up 15	.....	.....
May 16, 1935	Cut 15	.....	.....
June 26, 1935	Cut 15	.....	.....
July 16, 1935	Cut 10	.....	.....
August 29, 1935	.....	.....	Cut *4
September 6, 1935	Up 5	.....	.....
October 29, 1935	Up 15	.....	.....
November 1, 1935	.....	.....	Up *28
November 18, 1935	Up 15	.....	.....
December 6, 1935	.....	.....	Up *9
January 9, 1936	.....	Up 10	.....
January 13, 1936	Up 15	.....	.....
February 26, 1936	.....	.....	Up †5
December 28, 1936	Up 12	.....	.....
January 28, 1937	.....	Up 12	.....
February 24, 1937	Up 10	.....	.....

* Signal Hill 26 gravity. † Seal Beach 26 gravity.

Crude Production Taxes

Oklahoma—Five percent of gross value less royalty interest.

Texas—2¾ cents or 2¾ percent, whichever is higher.

Louisiana—From four to 11 cents a barrel, depending upon gravity.

Arkansas—2.6 percent of gross market values.

Montana—Two percent of gross value at well and ¾ of 1c per barrel.

New Mexico—Severance tax of 2 percent on oil and gas.

Wyoming and New Mexico—Production tax based upon state and county assessments.

California—.66443 mills per barrel of oil produced and 17.39 cents per acre on proved oil lands.

IN THE

Financial Field

First quarter earnings of oil companies higher for 1937 than for 1936

* * *

This year's profits expected to be substantially above those last year

* * *

Additional annual reports for 1936 indicate best earnings since 1929

The oil industry's favorable earning power of 1936 is being extended into 1937, as evidenced by several estimates now available on results in the first 3 months this year. Meanwhile, additional reports are being issued covering the year's results in 1936.

The continuation of favorable earnings naturally applies particularly to strictly producing companies, but integrated companies, too, are showing encouraging results.

Plymouth Oil Company, well fortified with producing properties, is expected to show profit in the first quarter of about $630,000 or 60 cents a share on the 1,050,000 shares of $5 par value, compared with $361,156 or 34 cents a share in the similar period last year, an improvement of about 75 percent.

Continental Oil Company, an integrated concern, is expected in the first quarter to show profit of about $2,800,000 or 60 cents a share on the 4,682,625 shares of $5 par value stock, compared with $2,114,521 or 45 cents a share in the first three months of last year, an increase of about 30 percent.

Plymouth Yearly Report

For 1936, Plymouth Oil Company and its subsidiary, Big Lake Oil Company, reported net income of $1,739,681, or $1.65 a share on the capital stock, the best earnings since 1930, and a gain of 137 percent percent over 1935, when net profit was $736,056, or 70 cents a share.

W. S. Hallanan, president of Plymouth Oil Company, in the annual report, stated that "further improvement of both crude and refined oil prices is probable." He added that "there is every indication at this time that profits for 1937 will rise substantially over 1936." He stated that the company's production was restricted considerably through proration, but was cheered by the reasoning that "The oil reserves remain under ground for future use and very probably, in the years to come, this crude will be sold at much higher prices."

Continental Oil Company

Continental Oil Company in 1936 had the best net income in 7 years, or since formation of the present company. The 1936 profit of the company and its subsidiaries was $9,612,597, including $1,295,230 net profit on sales of certain properties, and after depreciation, depletion, intangible development costs, federal and state taxes, minority interests, etc. That was equivalent to $2.05 a share on 4,682,614 shares of $5 par value capital stock, excluding 55,978 shares held in the treasury. In comparison, the net profit in 1935 was $8,813,561, or $1.88 a share.

Continental Oil Company has consistently charged against income its intangible development costs, chiefly drilling, and such expenditures in 1936 aggregated $9,009,995, or $1.92 a share, compared with $4,380,022 or 93 cents a share in 1935. The company's crude production was up 17.8 percent in 1936 over 1935, setting a new record. Gallonage of refined product sales also reached a new peak for the company.

Socony-Vacuum

Socony-Vacuum Oil Companys' net income for 1936 is expected to be approximately double that of the previous year. The profit for 1936 is estimated between $40,000,000 and $50,000,000, or $1.35 to $1.40 a share on the 31,708,456 shares of $15 par stock, compared with $22,525,892 or 71 cents a share in 1935. This estimate if fulfilled will represent the best earnings

CALIFORNIA CRUDE OIL PRICES (Posted February 26, 1936).

(All gravities above those quoted take highest prices of that field.)

Gravity	Signal Hill	Seal Beach Alamitos Heights	Huntington Beach	Inglewood	Playa Del Rey	Olinda Brea Canyon	Athens Rosecrans	Elwood Terrace	Torrance	Richfield	Whittier East Coyote La Habra	Montebello	West Coyote Hills	Santa Fe Springs	New Hall McKittrick Kern River Round Mountain	Mountain View	Midway-Sunset Buena Vista Hills Elk Hills	Lost Hills	Coalinga	Wheeler Ridge
14-14.9	$.80	$.79	$.78	$.79	$.80	$.76	....	....	$.80	$.76	$.76	$.77	$.78	.....	$.70	....	$.70	$.70	$.70	....
15-15.9	.80	.79	.78	.79	.80	.76	....	....	.80	76	.76	.77	.78	.....	.70	....	.70	.70	.70	....
16-16.9	.80	.79	.78	.79	.80	.76	....	....	.80	.76	.76	.77	.78	.....	.70	....	.70	.70	.70	....
17-17.9	.80	.79	.78	.81	.80	.76	....	....	.80	.76	.76	.77	.78	.....	.70	....	.70	.70	.70	....
18-18.9	.80	.79	.78	.84	.80	.78	....	....	.82	.76	.76	.77	.78	.....	.70	....	.70	.70	.70	....
19-19.9	.82	.79	.82	.87	.84	.81	....	....	.85	.76	.78	.77	.78	.....	.70	$.70	.74	.74	.71	$.70
20-20.9	.85	.79	.85	.90	.88	.84	....	....	.88	.78	.82	.77	.80	.....	.....	.70	.78	.78	.72	.70
21-21.9	.88	.79	.89	.93	.93	.88	....	....	.91	.80	.85	.77	.84	$.78	.....	.73	.82	.82	.74	.70
22-22.9	.92	.82	.92	.96	.98	.92	....	....	.93	.84	.89	.79	.88	.78	.....	.77	.87	.86	.78	.72
23-23.9	.95	.86	.96	.99	1.02	.96	$.84	....	.96	.88	.93	.82	.92	.78	.....	.80	.92	.90	.82	.76
24-24.9	.99	.91	1.00	1.02	1.06	.99	.88	....	.99	.91	.96	.85	.96	.82	.....	.84	.97	.94	.86	.79
25-25.9	1.03	.95	1.03	1.05	1.11	1.03	.93	....	1.02	.95	....	.89	.99	.86	.....	.88	1.01	.98	.90	.83
26-26.9	1.06	1.00	1.07	1.09	1.16	1.06	.98	....	1.05	.98	....	.92	1.03	.90	.....	.91	1.06	1.02	....	....
27-27.9	1.10	1.05	1.11	1.12	....	1.10	1.03	....	....	1.02	....	.96	1.06	.95	.....	.95	1.10	1.06	....	....
28-28.9	1.14	1.10	1.14	1.15	....	1.14	1.07	....	....	1.06	....	.99	1.10	.99	.....	.99	1.15	1.10	....	....
29-29.9	1.17	1.15	1.18	1.18	F.O.B.	1.17	1.12	....	....	1.09	....	1.03	1.14	1.03	.....	1.02	1.20	1.14	....	....
30-30.9	1.21	1.19	1.22	1.21	Pipe	1.21	1.17	F.O.B.	....	....	....	1.07	1.17	1.08	.....	1.06	1.25	1.18	....	....
31-31.9	....	.....	.....	1.24	Line	1.24	1.22	Ship	Kettleman Hills			1.11	1.21	1.12	.....	1.09	1.29	....	....	....
32-32.9	....	.....	.....	1.27	....	1.27	1.27	....				1.14	1.25	1.16	.....	1.13	1.34	....	....	....
33-33.9	....	.....	.....	.....	.....	.....	1.32	$1.28	1.19			1.18	1.28	1.20	.....	1.17	1.38	....	....	....
34-34.9	....	.....	.....	.....	.....	.....	1.37	1.32	....	1.23	....	1.22	1.32	1.25	.....	1.20	.....	....	....	....
35-35.9	....	.....	.....	.....	.....	.....	1.42	1.35	....	1.27	....	1.25	....	1.29	.....	....	.....	....	....	....
36-36.9	....	.....	.....	.....	.....	.....	1.46	1.39	....	1.31	....	1.29	....	1.33	.....	....	.....	....	....	....
37-37.9	....	.....	.....	.....	.....	.....	1.51	1.43	....	1.35	....	1.32	....	1.37	.....	....	.....	....	....	....
38-38.9	....	.....	.....	.....	.....	.....	1.56	....	....	1.39	....	1.36	....	1.42	.....	....	.....	....	....	....
39-39.9	....	.....	.....	.....	.....	.....	1.61	....	....	1.43	....	1.40	....	.....	.....	....	.....	....	....	....
40-40.9	....	.....	.....	.....	.....	.....	1.66	....	....	....	....	1.43	....	.....	.....	....	.....	....	....	....

since the company was formed in 1931 through the merging of Vacuum Oil Company with Standard Oil Company of New York.

Partially responsible for the unusually good showing for 1936 was the adoption of the policy of capitalizing and amortizing intangible development costs, chiefly drilling, over a period of years instead of charging the expense directly to current operations. The practice of capitalizing intangible development costs is fairly general throughout the oil industry.

Texas Corporation

The Texas Corporation, like numerous other oil companies, had in 1936 the most profitable year since 1929. The improvement over 1935 was nearly 125 percent. The Texas Corporation and subsidiaries for 1936 reported net profit of $38,260,341, after interest, depreciation, amortization of drilling costs, federal income taxes, $380,000 surtax on undistributed profits, and other charges. That was equivalent to $4.10 a share on 9,336,739 shares of $25 par value capital stock, excluding 514,515 shares held in the treasury. The profit in 1935 was $17,065,037 or $1.83 a share on 9,340,069 shares.

The Texas Corporation in 1936 set a new high record for itself on sales, produced 18 percent more crude oil than in 1935, and increased crude runs to refineries 15 percent over 1935. T. Rieber, chairman, and W. S. S. Rodgers, president, stated in the annual report: "Subsidiaries were active in the search for new production, and discoveries during the year were substantially in excess of withdrawals, thereby augmenting their total crude oil reserves."

Standard of Indiana

Standard Oil Company (Indiana) in a preliminary report including subsidiaries showed for 1936 net income of $46,800,000, or $3.08 a share, the most since 1930, and about 55 percent more than in 1935. For 1935 the company reported net income of $30,179,895, or $1.98 a share. These figures are after depreciation, depletion, amortization, minority interest, state and federal taxes. Standard Oil Company (Indiana) is among the world's largest oil refiners, and it has units that operate in nearly all states except on the Pacific Coast.

Derby Oil & Refining

Derby Oil & Refining Corporation and subsidiary, Derby Oil Company, reported for 1936 net income of $248,874, after depreciation, depletion, surrendered leaseholds, minority interest, etc., and after deducting $3,709 for provision for federal income tax and sur-tax on undistributed profits. After allowing for annual dividend requirements on 18,849 no-par shares of $4 cumulative preferred stock on which accrued undeclared dividends amount to $47 per share or 885,903, the 1936 income was equivalent to 66 cents a share on 263,141 no-par shares of common stock, excluding shares held in the treasury.

Chesebrough Manufacturing

Chesebrough Manufacturing Company for 1936 reported net profit of $894,919, after taxes and charges, or $7.46 a share on 120,000 shares of $25 par capital stock. In 1935 net profit was $690,034 or $5.75 a share.

McColl-Frontenac Oil Company, Ltd., and wholly-owned Canadian subsidiaries, for fiscal year ended January 31, 1937, reported net profit of $764,665, after depreciation, amortization, interest, taxes, etc., equal after 6 percent preferred dividends to 45 cents a share on 660,000 no-par shares of common stock. This compares with net profit in previous year of $1,226,904, or $1.16 a common share.

Richfield Oil Corporation

Richfield Oil Corporation recently filed an application with the San Francisco Stock Exchange to list $10,000,000 principal amount of the company's 15-year 4 percent debentures; 6,376,667 shares of common stock, and purchase warrants for 1,700,000 shares of common stock. Application was approved and trading will commence on approval of the Securities and Exchange Commission.

Richfield Oil Corporation plans to inaugurate soon an extensive drilling and exploratory program designed to increase its production and crude oil reserves. This was announced by Harry F. Sinclair, chairman of the board. The company has been prepared for the expansion program, as resent offerings of debentures and common stock, that were fully subscribed, will provide $20,000,000 additional working capital. Indicated net working capital of the old Richfield company on January 31, 1937, was $14,463,010, after deducting current liabilities, which is before consolidation with Rio Grande and before the financing. The ratio of Richfield's crude purchases always has been out of balance for profitable operations, it is stated, and the present plans are calculated to remedy that situation. The corporation also contemplates spending from $3,000,000 to $5,000,000 for equipment and in rehabilitating refineries, most of the expenditure to be on the Watson refinery.

JERSEY HIKES PAY

New York.—Coincidentally with a series of pay increases negotiated with thousands of wage earners in joint conferences, Standard Oil Company of New Jersey has granted substantial raises, effective April 1, to clerical and other salaried employes, it was announced March 30 by Frank W. Abrams, president. Employes of Standard Oil Company of Pennsylvania and Colonial Beacon Oil Company will enjoy similar increases.

Abrams explained that all office and other employes not participating in the advance just negotiated who are now receiving $1800 or less per year will get a flat monthly increase of $15 each. Those employes receiving salaries from $1800 per year up to executive levels will be considered individually by departments.

GET PAY INCREASE

Los Angeles. — Standard Oil Company of California raised the pay of practically all employes April 1 from 3 to 8 percent. Field workers making $7.50 per day or less were raised 40 cents per day; those making more than $7.50 per day were raised 20 cents per day. Office employes getting $145 per month or less received an advance of 40 cents per day, while those getting more than $145 per month were raised 20 cents per day.

NEW COMMISSION

Pennsylvania abolishes old public service board

Harrisburg, Pa.—A provision for regulating the Pennsylvania oil and gasoline industries was removed from the administration's bill setting up a new public utilities commission before final legislative approval was given the measure Wednesday. Governor Earle is expected to immediately approve the measure, which abolishes the 24-year-old public service commission, now Republican controlled, and substitutes a five-man commission which will be controlled by the governor.

Still awaiting legislative approval, however, is a resolution which would authorize a commission to study "regulatory legislation as may be needed to correct any abuses and evils" in the oil and gasoline industry.

Legislative Control Possible

The investigating commission is delegated by the resolution, which has been recommended for passage by a house committee, to determine whether the oil and gas industry "is so affected with the public interest" as to require regulation by the state. It is authorized to submit legislation designed to "correct any abuses and evils connected with the whole operation of the oil industry in this Commonwealth which are prejudicial to the interests of its citizens."

Answers Own Questions

In its preamble, the resolution answers its own questions. It asserts gasoline and oil to be "essentials of our modern civilization," declares that oil and gas prices "are at present subject to wide and unpredictable fluctuations," and charges that prices are "capriciously raised or lowered by the refiners of oils and gasoline in furtherance of their several ruthless ambitions to dominate their industry." The commission would be given wide powers of subpoena and investigation, and an appropriation of $5,000 for expenses.

While the resolution is the most important measure facing the oil industry in Pennsylvania, it is only one of many pending bills affecting the industry.

One measure has already received final legislative approval—extension of the one cent extra liquid fuels tax to May 31, 1939

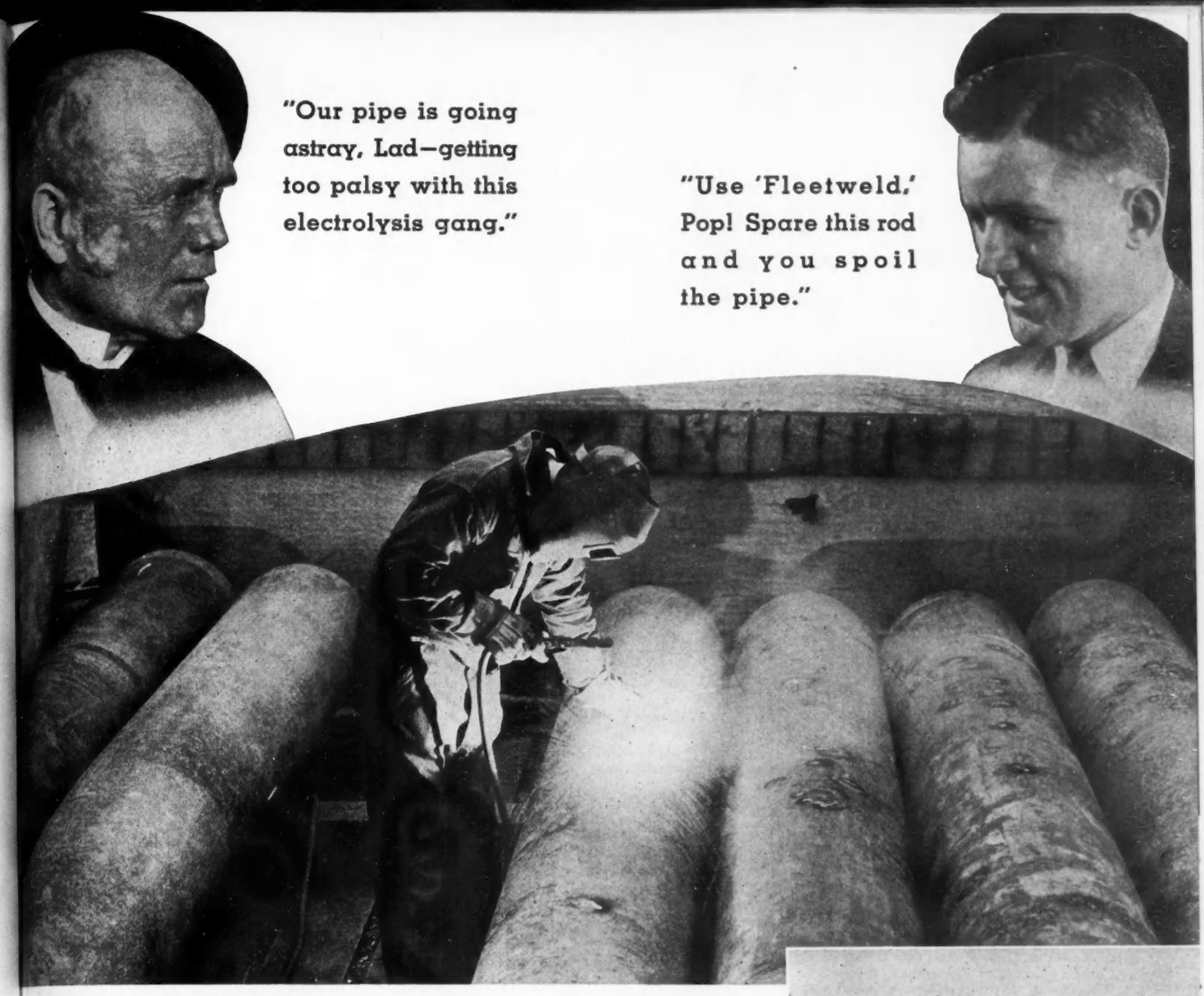
May Tax Heating Oil

A measure now before the house ways and means committee, which oil men see as a serious threat to the extended use of oil for heating, would impose a tax of 1½ cents a gallon, or fractional part, upon all fuel oil used or sold and delivered by distributors in the state. Sales to the state and its political subdivisions would be taxed, but fuel oil delivered to the United States government for operation of ships in interstate or foreign commerce would be exempt.

Nine other pending measures relate to taxation or sale of gasoline.

INDIAN LEASE AUCTION

Muskogee.—Oil and gas leases in 18 Oklahoma counties will be offered for sale at public auction here April 8, according to an announcement by A. M. Landman, superintendent of the Five Civilized Tribes. A total of 9,167 acres will be included in the 127 tracts to be put up. The sale will begin at 10 a.m.


"Our pipe is going astray, Lad—getting too palsy with this electrolysis gang."
"Use 'Fleetweld,' Pop! Spare this rod and you spoil the pipe."

"I'm glad you mentioned your trouble, Pop. Really, there's no reason for letting your pipe go to the dogs because of electrolysis or corrosion.—Not when you can overhaul it by these simple plans.

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WORLD DEVELOPMENT and TECHNOLOGY

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TURNER VALLEY WELL SETTLES TO 1200 BARRELS PER DAY

PRODUCTION of 1,350 barrels was made by Royalite Oil Company's Sterling Pacific 4, latest contribution to crude oil production in South Turner Valley, Alberta, Canada, in the first 24 hours of its test last week. It has since settled to a yield between 1,200 and 1,300 barrels, slightly above that of the B. and B. Royalties well which came in early in February as the largest in the British Empire.

Next test to reach the production stage will be Royalite Oil Company's Dalhousie 8, reported down 6911 feet, drilling 733 feet in the brom limestone. It is planned to continue drilling until the black lime is penetrated, when the heavy oil used as a drilling fluid will be removed by gas lift. This method was first used in this field on the Sterling Pacific 4 with remarkable success. Sterling Pacific 5, another Royalite test, was down 2172 feet, continuing remarkably fast progress made since the well was spudded a short time ago.

The expected completion of the Dalhousie 8 this week will transfer interest to the three wells of the Richland Oil Company which are grouped around the B. and B. well. Richland 3, now nearing the 5000-foot level, and Richland 1, drilling below the 500-foot level, are both about the same distance from Sterling Pacific 4. Richland 2, down more than 4000 feet, is just south of the B. and B. producer.

Taber Water Not Sulphur

Plains Petroleum Company's wildcat on the Taber structure, which was drilled to approximately 3250 feet, was producing about 50-50 oil and water. Preliminary tests reveal that it is not flowing sulphur water, as was at first feared, but a second analysis is being made. Officials are undecided whether to deepen the well 90 feet, the original objective, or to leave it producing from its present level, an unexpected stray sand. Its performance during the next week will determine whether the well is to be completed at its present level. In the event that the water can not be handled, the well can be carried to the limestone, as is the practice in North Montana fields. The second well in this region, however, will probably be drilled to the lower horizons to thoroughly test the field, said Homer Green, superintendent. Water intrusion is not to affect development plans in this region, as the wildcat is a profitable producer as it stands, yielding about 40 barrels of oil daily along with the same amount of water.

Wheat Men Petroleum, Limited, backed by Chicago and Winnipeg capital, announced its entrance into oil development in southern Alberta, with at least one well scheduled for this season. It will drill on acreage secured in the Delbonita and Twin River fields.

Sunshine Oil Company's Sunshine 1 wildcat, on the Del Bonita structure, is still awaiting acidizing equipment from the United States before scheduling a production test.

Throw Indian Lands Open

New regulations pertaining to drilling on Indian reserves in Alberta, which will particularly affect the Sarcee reserve, a northerly extension of the Turner Valley field, were announced by Hon. T. A. Crearar, minister of mines and resources. Right to prospect may be obtained upon payment of an annual fee of 50 cents an acre, or the land may be leased outright for $1 an acre annually. In both cases, certain development work is required. Royalty of 10 percent will be payable to the Indian board on oil found, and one percent on gas.

Deep Test for Petrolia

Drilling on the first deep test in the Petrolia oil fields of Ontario, discovered in 1861, will be started in April by McIntosh Oil & Gas Company. A rig has been moved to the site, 100 feet from the original well. In recent weeks, acidizing has been used in an effort to boost production of the numerous shallow producers of this area above the one to five-barrel marks they have been maintaining for some time.

Leasing in Manitoba

Canadian oil men will watch the test of Standard Oil Company of California, between Williston and Minot, North Dakota, which is scheduled for 9,000 feet on the Nesson structure. In view of this test, which is only about 50 miles from the Manitoba boundary line, there has already been considerable leasing of potential oil acreage in the southwest corner of Manitoba. Lisgar Oil Company has a well down 1200 feet in this region which has had important showings of oil and gas.

Another test east of Turner Valley area commanding interest is that of Montreal-Alberta Oil Company, situated about three miles northwest of Wainwright, Alberta. Drilled last year to 3440 feet, the well has been standing with 1400 feet of 40 Baume gravity oil in the hole. Little was done during most of the winter months, but the well is being cleaned for a production test. It is regarded as being of unusual importance because it is the only one in the field which has been drilled to the Devonian horizon, which is expected to contain commercial production. Other wells in the neighborhood have stopped at the Madison or Mississippian formation, and while there are several producers, none of them have been large and the oil has been of a much heavier grade. The Montreal-Alberta well is in the same horizon as the Baker wells in Montana.

IRAQ OUTPUT UP

Extend wildcat activities to West Tigris concession

Iraq's production of 29,521,023 barrels in 1936 represented a gain of more than 2,500,000 barrels over the 27,014,904 barrels produced in 1935, according to a statement made in a paper on Iraq, prepared by Ben B. Cox, geologist with Socony-Vacuum Oil Company, Inc., New York, for presentation before the American Institute of Mining and Metallurgical Engineers.

Cox's paper, which arrived too late for presentation before the annual gathering in New York, stated the principal development in Iraq during 1936 was the sale of Mosul Oilfields, Ltd., to Mosul Holdings, Ltd., a British company with French and American participation, and the expansion of the organization's wildcat activities to untested structures on its West Tigris concession.

Pressures and gas-oil ratios in Kirkuk field continued satisfactory following Iraq Petroleum Company's systematic exploitation program which has resulted thus far in all producing wells being flowing wells. Only sweet oil is being shipped out of Kirkuk now through the 4,000,000-ton pipe line, Cox said.

Naft Khaneh field continues to be normally exploited by Khanaqin Oil Company, Ltd., a subsidiary of Anglo-Iranian Oil Company, Ltd.

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MAY NOT BE SHUT IN

Standard of Bolivia wells probably are producing

Contrary to information from South America that oil wells of Standard Oil Company of Bolivia are closed in as a result of a report that the Bolivian government had alleged the oil company had evaded contract responsibilities, it is not likely the wells have been shut in.

Because of censorship imposed by the Bolivian government March 15 on outgoing messages and mail, details of what has transpired are not easily obtained in the United States. However, it is understood that when the government took over and sealed Standard Oil Company of Bolivia's office at La Paz and impounded the company's bank accounts, it also took over operation of the concern's two small refining plants. In that event the Bolivian government would keep the oil wells in operation to supply the plants with crude.

CANADA'S OUTPUT

February production of crude oil in the Province of Alberta, Canada, totaled 140,515 barrels, according to a statement released March 20 by C. W. Dingman, director, petroleum and natural gas division, Department of Lands and Mines.

Of the above, 137,933 barrels was limestone production from Turner Valley; 811 barrels was produced from the remainder of Turner Valley; 837 barrels was Red Coulee light crude production, and 874 barrels was Wainwright heavy crude production.

DEPARTMENT CREATED

By Mexican legislation to administrate petroleum

A federal law has been enacted authorizing the ministry of national economy to proceed with organization of Mexico's autonomous government department, to be known as General Administration of National Petroleum, which is to have considerable scope in the oil industry.

Principal functions of the department are to be: supervision over exploitation and exploration in the national petroleum reserves; development of the industry for national economic benefit; regulation of domestic markets and exports of petroleum and by-products to assure sufficient supplies of them for the nation, the government and the National Railways of Mexico; facilitating the employment of Mexican technicians in the industry, and to execute all classes of operations and works related with oil and gas production, acquisition, transportation, storage, refining and distribution.

The department's patrimony will be provided by government donations of movable and immovable properties resulting from the liquidation of Petromex, the government controlled, integrated oil company, as well as placing at its disposition lands in the federal oil reserves that were given Petromex, tracts in other reserves, and allowances from the federal expense budgets.

Management of the department will be in charge of a director general whom President Lazaro Cardenas will appoint, and other officials and employees, all of whom are to be public workers. The director general will be empowered to make exploitation contracts for lands in the reserves, the building of oil pipe lines and refineries, and any other operation, the worth of which does not exceed 20,000 pesos (about $5,600), contract loans for any amount, and arrange the annual works program and yearly expense budget.

CARDENAS SPEAKS

President Cardenas, who is known to have taken an active interest in formulating Mexico's new petroleum law, was quoted recently as saying that the government does not have in mind affecting in the least legally acquired interests of foreigners in Mexico.

"The petroleum law was enacted with the object of giving more impulse to the development of oil activities as Mexico possesses great oil deposits and properties that can be exploited with great advantage to the country," Cardenas stated.

NAVY WATCHFUL

Alberta fields are safest base for British fleet

British naval interests are understood to be watching closely the progress of crude oil developments in Alberta. Information to this effect was made public in Vancouver recently by General Garnet Hughes of Toronto, who spent some time there discussing oil matters with a number of his associates at the coast.

General Hughes contends that in time with crude oil wells coming into production in the extensive Alberta fields, pipe lines will also be constructed for hundreds of miles to carry the oils to markets similar to the great overland pipe lines now existing in the United States. He foresees oil from the Alberta fields being supplied either by pipe lines or by some other medium to royal naval stations, pointing out that even the towering Rockies and cold weather are not insurmountable obstacles to science.

General Hughes bases much of his belief on the fact that British oil fields in Mesopotamia and Burma are vulnerable at the present time, while Alberta oil fields offer the safest source of naval supply within the British Empire.

General Hughes is president of Pacalta Oils, Limited, and a director of South End Petroleums Limited. These companies have drilling programs in Turner Valley which will be considered during the General's stay at Vancouver.

TO GET REFUND

The ministry of finance of Mexico must refund to Mexican Petroleum Company a fine of 60,000 pesos (some $18,500) it imposed for alleged violation of the oil fiscal law of 1932, the federal supreme court has ruled. The tribunal upheld the company's contention that imposing the fine was retroactive.

SYNDICATE BLAMED

Mexican operators assert would call general strike

Charges that the national syndicate of oil workers of Mexico desires to bring about a general strike unless the companies grant them economic demands which the employers assert are exorbitant, are made in a public statement issued by Huasteca Petroleum Company, Mexican Eagle Oil Company, Pierce Oil Company, California Standard Oil Company of Mexico, Mexican Sinclair Petroleum Corpration, Richmond Petroleum Company of Mexico, Penn Mex Fuel Company, Consolidated Oil Company of Mexico, and Stanford and Company. The statement says, in part, as follows:

"The syndicate of petroleum workers has abruptly announced that a general strike will be called if its proposition for a contract, full of exorbitant demands, is not accepted by the companies to which it was presented last November. To totally suspend the activities of an industry that is so vitally important to the economic life of the republic, the syndicate seeks justification with the charge that the companies seek to destroy 'conquests gained by the petroleum laboring class.'

"That Assertion Is False"

"That assertion is false; the companies are not seeking a contract-law which would impose upon the personnel of the petroleum industry economic and work conditions that are inferior to those that actually exist. On the contrary, propositions the companies have made to labor delegates during discussions of the contract-law contain economic-social benefits that are better than those allowed in any collective contract in force, considered as a whole. We are ready to demonstrate that fact at any time.

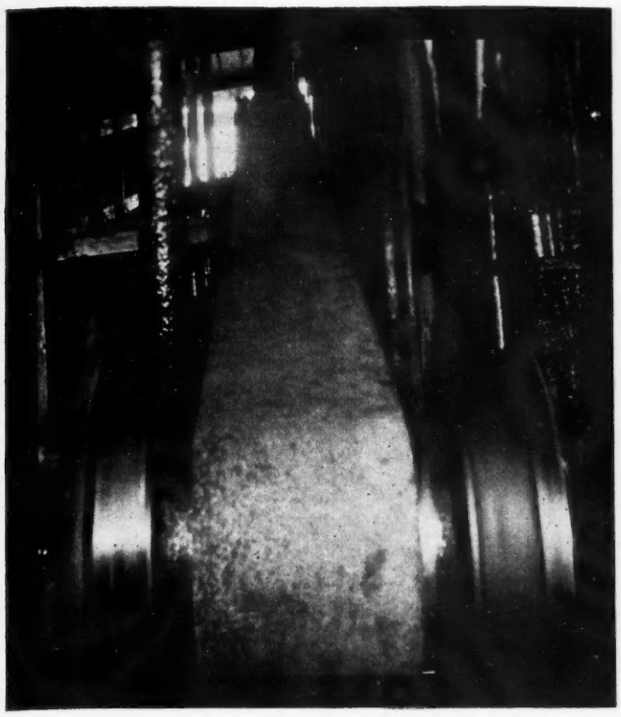
"The systematic attitude of the labor delegates in rejecting the most reasonable propositions of the companies is inspired by the fear they have that the petroleum workers will think that because of their failure to obtain their insane demands they are now weak or partial to the companies. They believe that in order to emerge triumphant from the situation in which they find themselves there is nothing else to do but to call a general strike, even though it would have disastrous consequences for their own people.

"Faced with the threat of a general strike, we take this occasion to assert that: the oil workers enjoy wages and economic benefits that are so much better than those of many other workers that they are the spoiled children of Mexican industry.

PRODUCTION DOWN

February petroleum production in Mexico is estimated at 3,922,929 barrels by the ministry of national economy. The output in the corresponding month of last year was 3,286,506 barrels.

The ministry rectifies January's Production at 4,233,635 barrels, explaining that the estimate of more than 6,000,000 barrels for that month was due to a miscalculation.



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OKLAHOMA FIELDS

Surprise production found south of Fitts pool

* * *

Jesse outpost is extension or new discovery

* * *

Abandoned Stephens County well becomes gasser

Tulsa.—Overshadowing every other phase of drilling activity in this sector of Oklahoma last week was the surprise production found south of Fitts and the northwest extension of the Jesse field, both in Pontotoc County.

Oil South of Fitts

E. H. Moore's Muse 1, SW NE SE 33-2n-7e, across the fault and south of production in the Fitts, was the most interesting of the two tests when, after plugging back to test the Viola and Hunton limes, it flowed 452 barrels of oil in one hour and 166 barrels of oil another hour. The well had been drilled to 5253 feet in Wilcox sand, but because salt water was found, it was decided to make a test of the upper horizons. It was then plugged back to 4570 feet, and 4000 gallons of acid run into the hole. A faulty plug allowed the acid to leak out however, and it was necessary that another treatment be made. Operators reacidized with 10,000 gallons and placed a 210-barrel oil load on top of the acid. When opened, the well made the initial flow.

The following day Muse 1 flowed 71 barrels of oil the first hour and 79 barrels the second hour through casing. Later, while tubing was being run, the well flowed 105 barrels of oil in one hour and made from 10,000,000 to 12,000,000 cubic feet of gas.

Another 10,000 gallons of acid was run March 29, and the well kicked off, was unloaded, and flowed 150 barrels of oil the first 30 minutes, 136 barrels the next 45 minutes and 147 barrels of oil per hour for the next two hours, a total flow of 580 barrels of oil for three hours and 15 minutes. When reopened later in the week, it made 92 barrels of oil through tubing and 56 barrels of oil in another 30 minutes, with 2,000,000 cubic feet of gas and was again shut in.

Northwest Extension for Jesse

Mid-Continent Petroleum Corporation brought in Statler 3, SE NE SW 2-1n-7e, to extend the northwest edge of the Jesse pool. Statler 3 topped the Bromide sand at 4500 feet and drilled to 4510 feet, from whence it flowed 1695 barrels of oil in 2½ hours and was shut in. Gas was estimated at 10,000,000 cubic feet. The first three hours of the potential test the well flowed 240 barrels of oil the first hour, 190 barrels the second and 180 barrels the third, all through 2½-inch tubing.

Two schools of opinion have formed concerning the areas. One is holding out for an extension of Jesse to the northwest beyond Statler 3, and linking up with area surrounding Muse 1. The other contends Muse 1 is the key well to a new field south of Fitts and separated therefrom by the decided fault to the south of the field proper.

Neither Mid-Continent Petroleum Corporation nor E. H. Moore, Incorporated, have announced an offset location for the new producers. Muse 1 will be given thorough tests before any further plans are made. Mid-Continent officials are closely watching Statler 2, NE SE SW 2-1n-7e, midway between Statler 1 and 3, which is drilling ahead below 2820 feet.

Extend Hunton Lime Zone

Along with the other events in the Fitts-Jesse area was the finding of Hunton lime production in the southwestern portion of Fitts. Burke-Greis Oil Company's Chambers 6, SW NW NW 36-2n-6e, was drilled to 4829 feet and then plugged back to 3965 feet where it was twice acidized following perforation of casing. The well then flowed 195 barrels of oil the first hour; 192 barrels the second; 185 barrels the third; 182 barrels the fourth, and 182 barrels the fifth hour, making a total production of 956 barrels. It was given a potential of 4234 barrels of oil.

Chambers 6 extends Hunton lime production one-quarter mile southwest. It is a direct east offset to Blackstock Oil Company's producer from the Bromide. Chambers 4, SE NE NW 36-2n-6e, is to be plugged back to the Hunton.

Start Several New Ones

Several new tests have been started in the immediate area as a result of findings in Chambers 6. Phillips Petroleum Company has made location for Norris 16, SW SE SW 25-2n-6e, as a twin to Norris 8, a Hunton lime test. E. H. Moore has started Akers 14, NW SW SE 36-2n-6e, a twin to Chambers 6 and scheduled to be a Hunton lime test.

There were many good completions in other parts of the field. Magnolia Petroleum Company's Metropolitan Life Insurance Company 30, SW NE SW 27-2n-7e, topped Viola lime at 3630 feet and drilled to 4280 feet, where it established a potential of 2849 barrels of oil and had 3,423,000 cubic feet of gas. Its Shelton 2, SW SE SW 28-2n-7e, established a 24-hour potential of 1379 barrels of oil and 3,717,000 cubic feet of gas.

Blackstock Oil Company's Harden 2-A, NE SE NW 30-2n-7e, topped Hunton lime at 3426 feet and drilled to 3745 feet. The well made a potential of 2303 barrels of oil and had 1,500,000 cubic feet of gas.

Loual Drilling Company's Harden 4-A, NE SW NW 30-2n-7e, topped Hunton at 3435 feet and drilled to 3718 feet, where it established a potential of 2494 barrels of oil with no gas gauge.

E. H. Moore's Woodruff 5-B, NEc SE 29-2n-7e, topped Hunton at 3257 feet and drilled to 3530 feet, where it made a 24-hour potential test of 2609 barrels of oil and 4,560,000 cubic feet of gas.

Many Good Completions

Skelly Oil Company and Phillips Petroleum Company's Metropolitan Life Insurance Company 1-B, SE NE SW 23-2n-7e, drilled to 3640 feet and flowed 724 barrels of oil in five hours through tubing. It was acidized with 10,000 gallons and flowed 201 barrels of oil in one hour through tubing. Potential for 24 hours on the well amounted to 5353 barrels of oil and 2,260,000 cubic feet of gas. Production was from Hunton lime.

E. H. Moore's McCarty 3, NW SW SE 23-2n-7e, drilled to 3840 feet and flowed 362 barrels of oil the first hour through pressure drill and was shut in. When opened the second hour, it flowed 363 barrels of oil and was shut in to take potential. Moore's Akers 12, NWc NE 36-2n-6e, topped Hunton at 3481 feet and flowed 324 barrels of oil in two hours after reacidizing with 10,000 gallons. The well was flowing through tubing. It made a potential of 2856 barrels of oil; Akers 11, SW NW NE 36-2n-6e, topped the Hunton lime at 3151 feet and was acidized with 5000 gallons. It flowed 160 barrels of oil the first hour through casing and was reacidized with 10,000 gallons. The well then flowed 310 barrels of oil in one hour through tubing and was shut in for potential.

Fleetborn Oil Company and Simpson's Wooley 8-A, SW NE SE 27-2n-7e, drilled to 3527 feet in the Hunton lime and made a 24-hour potential of 2250 barrels of oil and 2,920,000 cubic feet of gas.

Phillips Petroleum Company's Bates 4, NW NE NW 26-2n-7e, topped the first sand at 4287 feet and drilled to 4300 feet, where it established a potential of 2130 barrels of oil in 24 hours.

Magnolia Petroleum Company's Norris 10, SE NW SE 21-2n-7e, came in to flow 359 barrels of oil in one hour through casing after acidizing with 10,000 gallons in the Viola lime at 4310 feet. The well was shut in for potential.

Stanolind Oil & Gas Company and Amerada Petroleum Corporation's Martha 1, NE SW NW 36-10n-7e, extended

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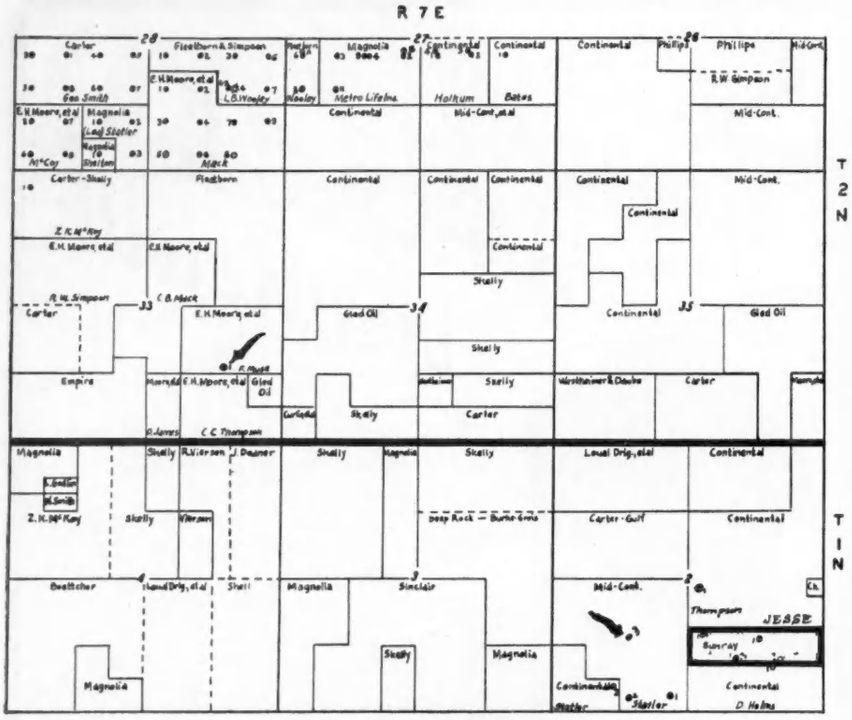


More Jesse or a new field is the question. Cause of conjecture is E. H. Moore's Muse 1, SW NE SE 33-2n-7e, across the fault and south of the Fitts field, which is producing from a plug-back depth of 4570 feet in the Wilcox sand. Some see a possibility the well is on the northwest end of a structure from Jesse, extended last week by Mid-Continent's Statler 3, SE NE SW 2-1n-7e, which is producing from 4510 feet in Bromide sand.

the North Bethel pool of Seminole County southeast last week when it flowed 287 barrels of oil in 13 hours from the Cromwell sand at 2647 feet. It was completed after flowing 115 barrels of oil through tubing in 4 hours.

Gulf Oil Corporation's McIntosh 1, SEc 36-10n-7e, flowed 140 barrels of oil in 19 hours and 80 barrels of water from 3627 feet.

Five Wetley Locations

Lynch et al's Doner 1, SWc NE 24-5n-5e, Wetley pool, Seminole County, was making 250 barrels of oil natural flow from the base of the Hunton lime, and because of the producer, 5 new locations have been made in the area. Lynch made location for Doner 2, SE SW NE 24-5n-5e; W. E. McBride, Inc., made location for Swan 1, SEc NW 24-5n-5e; Magnolia Petroleum Company made location for Fee 1, NWc SE 24-5n-5e; Francis Oil & Gas Company made location for Kinney 1, SW SE NE 24-5n-5e, and Fleetborn Oil Company made location for Fee 1, NEc SW 24-5n-5e.

Sinclair Prairie Oil Company's Letka 1, SEc NW 35-11n-5e, North Earlsboro, was acidized with 3000 gallons through perforated casing in upper Hunton lime and flowed 170 barrels of oil in 3 hours, cutting 60 percent water and basic sediment. It was drilled to 4497 feet.

Amerada Petroleum Corporation and Stanolind Oil & Gas Company's Smith 1, NE SW SW 3-10n-5e, was shut down after making 278 barrels of oil and 78 barrels of water in 19½ hours from the Wilcox sand at 4668 feet.

Winona Oil & Gas Company's Harjo 1, SW SE NW 20-7n-8e, West Holdenville area, Hughes County, was shot with 50 quarts between 2787 and 2925 feet and was cleaned out, swabbing 75 barrels of oil in 8 hours. The well later flowed 124 barrels of oil in 24 hours and cleaned out. The following day it flowed 108 barrels of oil in 24 hours and was cleaning out once more when last reported.

Seek Moore Extension

Oklahoma City.—Hope is being held out for another extension of the Moore pool, where a new test is being started, and a possibility is seen for production in two Noble County tests which looked rather disappointing a week ago.

Anderson - Prichard Oil Company, which recently extended the Moore pool of Cleveland County to the north, made location for State 3 last week in SW NW SE 16-10n-2w, due north of its recent completion, State 2. State 2 was connecting up with tank lines after testing in the Wilcox sand at 7262 feet.

Shell Petroleum Corporation's Guthrie 1, C NW SW 31-21n-2w, in the North Lucien pool of Noble County, was waiting on cement after running casing to shut off water found in sand from 5497 to 5500 feet. After finding the second Wilcox sand, the well was opened and flowed 35 barrels of oil into tanks and was then shut in. The company's Tate 1, C SE NE 36-31n-2w, on the Garfield County side of the pool, drilled to 5356 feet and was shut down waiting the outcome of Guthrie 1.

Indian Territory Illuminating Oil Company announced location for a test in NWc 24-6n-1e, in southeastern Cleveland County, on a structure which has interested oil men for many years. The test will be southwest of the Wanette pool and southeast of Purcell.

Well Gauges 5373 Barrels

Continental Oil Company's Young 15, SW NW NW 31-14n-3w, in the Edmond pool of Oklahoma County, made a 24-hour potential gauge of 5373 barrels of oil and 15,000,000 cubic feet of gas. A potential test taken one week before was 1429 barrels of oil and 3,000,000 cubic feet of gas. It was discovered the hole had bridged following the first potential and it was necessary to clean out before going ahead with the test.

Shell Petroleum Corporation and Phillips Petroleum Company's McCaughtry 6, SW SE NE 21-23n-2w, Billings pool, flowed 751 barrels of oil the first 6 hours with drill pipe in the hole, production coming from the Wilcox sand at 4334 feet. Operators were preparing to test.

"Dry Hole" Gassing

Ardmore.—Helmerich & Payne's Graham 1, SWc NE 12-1n-5w, in the Doyle sector of Stephens County, which, although temporarily abandoned as a dry hole at 5014 feet, last week suddenly became a gasser of its own accord.

Graham 1 had been shut down for three weeks. Companies supporting drilling of the test withdrew their support, the well having reached its contract depth with nothing showing. The crew pulled pipe and capped the surface pipe. Then the well suddenly blew in through the cellar. It is thought to be good for 10,000,000 to 15,000,000 cubic feet of gas, coming from an unknown source. Doyle pool ordinarily produces from around 1000 feet, and the largest gasser previously found there gauged only about 3,000,000 cubic feet. Operators were having a difficult time bringing the well under control, as all but about 90 feet of surface casing had been pulled when the well was shut down.

Other parts of the area were quiet. Magnolia Petroleum Company made location for Brown 1, SW SE SE 21-3s-18w, in an unexplored portion of Tillman County, north of Davidson. It is 4½ miles southwest of Indian Territory Illuminating Oil Company's Hatler 1, Section 32-2s-17w, on pump at present.

OKLAHOMA

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
CADDO COUNTY—		
Magnolia, Sames 5, nw nw ne 35-6n-10w	¶7¾	5372
CARTER COUNTY—		
C. P. Williams et al, Brady 3, se ne sw 19-1s-2w	lcn.	abd.
Samedan Oil, Pierce 11, ne ne sw 7-2s-2w	*	2700
Magnolia, Heffner 7, se nw ne 27-2s-3w (otd 2255)	¶1½	2834
Pure Oil, Lowery 32, sw se se 4-4s-3w (pb 935)	4	1115

[*See next page*]

M.I.W. STEEL DERRICKS

a thing of BEAUTY and.. .... a PRACTICAL JOY to DRILLERS

122-ft., 537,000 lb. capacity galvanized MIW derrick on a 7-ft. galvanized MIW sub-structure, being used on the Gulf Coast.

MUSKOGEE IRON WORKS

STEEL DERRICKS SUBSTRUCTURES — RIG FRONTS — MIW — ENGINE BASES FRAMING SILLS — SKID-TYPE HOISTS

1802 Esperson Bldg. Houston, Texas | Gulf States Bldg. Dallas, Texas | Main Office and Plant Muskogee, Oklahoma | Thompson Bldg. Tulsa, Oklahoma | Kilgore, Texas

Company, Well and Location	Init. Prod. Bbls.	Depth
COAL COUNTY—		
Ruwald & Couch, McMilan 1, sw sw sw 10-1s-8e	*	1414
CREEK COUNTY—		
Sooner O&G, Steil 1-A, se ne se 7-16n-11e	*	2325
Strozier, Anthis 1, sw sw ne 12-16n-11e	35	2355
Klingensmith, B. Gilcrease 5, cel se se 33-17n-12e	120	2300
Acid Oil, Deere 3, cnw 7-17n-7e	lcn.	abd.
Akin Oil, Smith 2, ne nw se 9-17n-8e	*	1416
M. S. Hughes, Flinchen 2, ne nw sw 11-19n-9e	lcn.	abd.
GARVIN COUNTY—		
Cox & Hammon, Perry 1, se se sw 32-1n-3w	195	3219
HUGHES COUNTY—		
Olympic Oil, Haning 1-A, nw nw se 1-7n-8e	15	2842
Ohio Oil, Harjo 1, se se ne 2-9n-8e (pb 1728)	7	1775
Mid-West Oil, Turner 1, cse nw 13-9n-9e	¶28	2904
Texas Co., C. H. Baskin 1, cnw ne 9-8n-10e (pb 3118)	*	3180
KIOWA COUNTY—		
C. E. Phelps, Cline 1, ne ne se 6-6n-16w	*	435
LINCOLN COUNTY—		
Skelly, Spur 1, se se ne 20-17n-3e (pb 4602)	175	4648
LOGAN COUNTY—		
Carter & Gulf, Walker 5, ne nw ne 33-17n-4w	¶17½ & 7636	6285
OKFUSKEE COUNTY—		
Kemrow et al, Simpson 1, se se nw 25-10n-8e	*	1855
Blackwell et al, Lehmer 1-A, se sw se 7-10n-9e	*	1938
Delaney, Lewis 2, sw se se 7-10n-9e	50	1898
Arkansas Royalty, Fisher 7, sw nw se 18-10n-9e	216	1904
Chapman, Yarbraugh 4, se se ne 18-10n-9e	117	1939
Sinclair Prairie, Schultz 2, sw ne nw 18-10n-9e	107	1886
Chapman et al, F. Willams 6, se nw nw 30-10n-9e	363	1788
OKLAHOMA COUNTY—		
Clark & Co., Barcliff 1, sw nw nw 23-12n-3w	¶5¼ & 672	6494
E. W. Jones et al, Hidiger 1, nw nw se 6-13n-3w (pb 6625)	*	6685
Magnolia, School Land 1, ne ne ne 36-14n-4w (pb 6585)	2 & 952	6707
OKMULGEE COUNTY—		
H. Smith, Jefferson 1-B, nw ne ne 9-14n-15e	*	1435
A. Labenne, Bruner 8, se ne sw 23-15n-11e	1	1836
OSAGE COUNTY—		
Bay Oil 3, se nw sw 25-22n-7e (pb 2867)	*	2941
A. E. Pusser, 8, sw ne se 5-22n-11e	*	1190
Lewis & Peters, 2, sw sw sw 27-24n-7e	834	2630
Lewis Prod., 13, nw se ne 28-24n-7e	75	2706
PONTOTOC COUNTY—		
Moore, McCarty 2, ne sw ne 22-2n-7e	¶5 & 4737	3830
Skelly, Metropolitan Life 9, ne se sw 23-2n-7e	3 & 4510	3945
Carter, Smith 12, ne ne sw 28-2n-7e	¶1½ & 347	3470
Magnolia, Simpson 17, sw se ne 29-2n-7e	¶2 & 277	3568
Moore, Harper 6-A, se nw ne 29-2n-7e	1 & 256	3765
Magnolia, Hardin 11, ne nw ne 30-2n-7e	¶2 & 995	3885
Delaney, Russell 2, sw ne sw 7-4n-8e	*	2585
Vaughn & Senora, J. A. Burk 1, nw sw nw 33-5n-5e	70	2500
POTTAWATOMIE COUNTY—		
Gulf et al, Benjamin 1, se ne nw 13-7n-4e	977	4133
Stanolind, U. R. Rushing 2, se sw se 32-11n-4e	586	4431
SEMINOLE COUNTY—		
Lynch, Hyde 1, sw sw ne 24-5n-5e	¶2 & 431	2696
Pure Oil, Strothers 14, nw sw sw 26-9n-6e (otd 4021)	50	4116
Ross Oil, Davis 2, se sw nw 16-9n-7e	70	3458
Crosbie, Harjoche 1, ne nw ne 35-10n-7e	*	4574
J. Hall, Harjo 2, ne se nw 36-10n-7e	75	3631
STEPHENS COUNTY—		
Helmerich & Payne, Graham 1, sw sw ne 12-1n-5w	*	5014
TULSA COUNTY—		
Duffield, Fisher 4-A, nw ne sw 1-17n-12e	*	1330

*Failures; †Junked; ¶Million cu. ft. gas.

KANSAS FIELDS

Clyde Pulse's Reno County wildcat discovers pool

★ ★ ★

Walters field appears to have major proportions

Wichita.—Drilling development in Kansas last week held to a high level. One new pool was reported; another seems certain; a pool was extended, and an important strike was made in southeastern Kansas.

New Reno County Pool

Credit for the new producing area goes to Clyde Pulse et al's Payne 1, SW NW NE 4-22s-7w, which gave Reno County the new pool. The hole filled 2700 feet with oil overnight from the Kansas City lime at 3244 feet, and appears good for 150 to 200 barrels of oil daily. The well, located almost on the northern boundary line of the county, was dry in the lower horizons, and was plugged back to test the showing in the lime. It is the first wildcat strike in the county since the Lerado pool was opened November 10, 1935, by Shell Petroleum Corporation's Reese 1, CW½ W½ SW 11-26s-9w.

Indian Territory Illuminating Oil Company's Schrepel 1, SEc NE 26-20s-11w, southeast of Ellinwood in Barton County, encountered a small showing of oil at 3301 feet in the Siliceous lime and was showing for a bailer of oil an hour from between 3305 and 3306 feet. The well was drilled ahead to 3310 feet with no increase in production noticed. Showings of oil were picked up after the plug was drilled at 3293 feet in the top of the lime. Schrepel 1, south of production in the Peter pool about 1½ miles, was first looked on as an extension well, but may open a new pool. It filled 1800 feet with oil in a little more than three hours late in the week, production coming from 3325 feet in the Siliceous lime, topped at 3293 feet. When last reported the well had made a potential of 497 barrels of oil in 11 hours and 40 minutes and was shut in for tankage.

Walters Extended

Carter Oil Company's Staab 1, CNW 11-12s-18w, extended production three locations to the south in Walters pool, Ellis County, and marked the field as one of major proportions. The hole filled to the top with oil in four hours after the plug was drilled out. Top of the Siliceous lime was found high at 3615 feet. When tools went through the plug, 1000 feet of oil rose in the hole within 30 minutes, and at the end of 55 minutes the column had risen 1700 feet. A pumping test was scheduled.

Sinclair Prairie Oil Company made an important strike in the old Sedan pool of Chautauqua County. Casement 5, in Section 32-33s-11e, was reported flowing seven to eight barrels of oil an hour, with 3,500,000 cubic feet of gas coming from 1774 feet in Mississippi lime. This is the first production in the area from Mississippi lime.

Routine drilling was reported from most other sections of the state. Tom Deal and Wolf Creek Oil Company's Freiling 1, NWc SW 4-12s-17w, northeast of Hays in Ellis County, which extended production one-half mile east in the Shutts pool, pumped 990 barrels of oil natural in 18 hours from the Siliceous lime at 3529 feet before the rods parted. The well averaged 55 barrels of oil during the 18-hour test.

Discovery Offset Showing

Bridgeport Machine Company's Kraus 1, NEc SE 21-14s-19w, an offset to the discovery producer in Kraus pool, had 500 feet of oil in the hole from the basal sand between 3749 and 3753 feet. Five-inch casing was set at 3726 feet in the conglomerate but will be reamed down to 3749 feet and cemented before the test is drilled in.

S. A. Murphy and Western Kansas Oil & Refining Corporation's Thome 1, SWc NW 19-28s-1w, Sedgwick County, topped the chat at 3410 feet and cored from 3434 to 3455 feet. Recovery consisted of three feet of core, bearing a stain of oil. Operators decided to run eight-inch casing to 3434 feet and test before drilling ahead.

Cameron, Pulse et al's Homer Smith 1, SW SE SE 13-27s-2e, each of Wichita, was attempting to recover tools lost in the hole at 2782 feet nearly two weeks ago. A new hole was being made alongside the old one at a point where the tools were lost, operators hoping the tools would fall into the new hole where they could be fished out. If the attempt is not successful, a liner will be run and drilling will continued in the new hole.

Continental Oil Company's Michekls 1, NEc SW 12-18s-8w, 1¼ miles north of production in Genesea pool, Rice County, was completed for 1241 barrels of oil natural from the Siliceous lime at 3212 feet.

Reserve Oil Company's Patton 1, SW NW NW 16-21s-7w, in the Hauschild pool of Rice County, flowed 1050 barrels of oil during a six-hour test and

was given a potential of 3980 barrels of oil from the conglomerate at 3375½ feet.

Atlantic Oil Producing Company's Gossman 2-A, in Section 8-21s-7w, was given a potential of 1137 barrels of oil

[*Continued on page 112*]

KANSAS

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
BARTON COUNTY—		
Texas, F. Bloomer 6, se se ne 36-17s-11w	1513	3286
Spencer & Yarnell, Gemunhardt 3, se se sw 36-17s-11w,	1086	3309
Stanolind, Burmeister 1, ne ne sw 33-19s-11w	*	3363
Hilligoss et al, Isern "B" 4, se ne ne 12-20s-11w	1730	3312
BUTLER COUNTY—		
Siefkin et al, Alexander 1, nw sw ne 15-28s-4e (otd 1440)	*	2130
COFFEY COUNTY—		
P. R. Hart, Hanna 5, ce½ nw sw 11-23s-13e	50	1799
COWLEY COUNTY—		
Lloyd, Frost & Study, McKinley "B" 3, se se nw 33-31s-3e	2730	3269
ELLIS COUNTY—		
Lario O&G, Cress 1, ne ne ne 13-11s-17w	2362	3398
GREENWOOD COUNTY—		
Simmons Oil, Ellis 4-B, se se ne 27-23s-11e	40	1955
McPHERSON COUNTY—		
Hutchinson O&G, Thomas 1, se ne sw 26-19s-2w	lcn.	abd.
RENO COUNTY—		
Shell, Ratzlaff 1, se sw se 2-23s-4w (pb 3397)	*	3610
Barnsdall, Westfall "B" 1, ne ne se 19-24s-4w	715	3387
Wakefield, Yoder 1, sw sw sw 34-24s-5w	*	3465
Helmerich & Payne et al, Evans 1, ne ne se 29-24s-6w	lcn.	abd.
Empire, Fluke 1, nw ne sw 15-26s-9w	2265	4163
Ohio Oil, Lawson 3, nw ne nw 15-26s-9w	936	4159
RICE COUNTY—		
Texas Co., C. Kleile 5, se sw sw 34-19s-10w	1501	3333
Continental et al, Mickels 1, ne ne sw 12-18s-8w	1241	3212
Gulf Oil, A. J. Stolz 11, sw nw nw 32-19s-10w	559	3292
Knop 5, sw ne nw 33-19s-10w	1114	3290
Stolz Jr. 12, sw ne nw 5-20s-10w	1263	3303
Stanolind, Specht 12, nw nw se 6-20s-10w	1083	3329
Tatlock, Berscheidt "B" 8, se ne sw 6-20s-10w	960	3305
Magnolia, Bayer 6, se nw nw 7-20s-10w	625	3290
Atlantic Oil, Gossman 1, ne ne se 8-21s-7w	367	3368
RUSSELL COUNTY—		
Stanolind, Austin-Ashby 3, nw ne sw 30-12s-15w (pb 3317)	106	3367
Empire, Ehrlick 8, se sw se 28-13s-14w	749	3307
Billings, Herbel 1, se ne sw 26-14s-14w (otd 3025) (pb 3125)	610	3205
Braden & McClure, Herbel 1, ne ne nw 35-14s-14w (otd 3168)	877	3175
Shell, Michaelis 8, sw sw ne 31-15s-13w	2704	3268
W. I. Southern, Inc., Boomhower 4, se se nw 32-15s-13w	1307	3314
Boomhower 5, ne sw nw 32-15s-13w	2678	3268
Empire, Michaelis 1, cn¼ n½ se 27-15s-14w	258	3372
SEDGWICK COUNTY—		
Empire et al, Jordan 1, sw sw nw 15-25s-14w	2035	3943
STAFFORD COUNTY—		
Lario & Atlantic, Morgan 2, cn½ n½ se 23-24s-13w	1444	4075
SUMNER COUNTY—		
Texas Co., E. Carr 3, ne nw ne 5-32s-1w	330	3692
Patton Drlg., Rogers 1, sw nw sw 35-31s-2w	*	4406
WOODSON COUNTY—		
Gillespie & Sons, Houghlan 1, se sw ne 3-24s-15e	12	1490
B and B Oil, Corkey 1, cn½ nw nw 29-25s-14e	250	1440

*Failures; †Junked; ¶Million cu. ft. gas.

NORTH AND WEST TEXAS

North Permian Basin production advanced 11 miles

* * *

Theory saturated lime blankets vast area supported

* * *

Exploration scheduled for Reese-Loving County

Midland. — Oil production in the north portion of the Permian Basin was advanced about 11 miles east by south into southwestern Hockley County the past week through wildcatting efforts of The Texas Company et al on the Slaughter ranch. The well began showing free oil from lime at 4980 feet, or 1420 feet sub-sea, and at 5020 feet flowed a small head of 30.6 gravity sulphur oil. Drilling was halted at this depth to connect flow line to tanks. Slaughter 1 is located 665 feet from west and 725 feet from south lines of Labor 83, League 38, Zavala County School Lands, near center of a 6000-acre block assembled in February, 1936, to make a 5000-foot test. T. J. Drilling Company was awarded the contract, using cable tools below 2350 feet. Nearest production is Honolulu Oil Corporation and Cascade Petroleum Corporation's Duggan Bros. 1, southeastern Cochran County wildcat which began producing last October from lime pay topped at 5018 feet, or 1325 feet below sea level. The latter was officially completed last January flowing 396 barrels of 27.7 gravity oil after plugging back from 5098 feet to 5068 feet to exclude water and shoot with nitro. It was acidized twice.

These two isolated wildcats are the northern most outposts for production in the basin area. Several old tests drilled in central Cochran County yielded free oil from the same lime horizon, but were abandoned after deepening to water. Yoakum, Gaines and Dawson Counties have contributed oil producers within the past two years, thereby establishing production over a wide front in the north basin area. Geological information provided by these strikes and non-related failures support the theory that oil-saturated lime blankets a vast area. The oil bearing lime section is comparatively thin, and operators must be content with comparatively low crude yield per acre. The Seminole structure, Gaines County, has the distinction of being the only one of the six separate oil strikes in the five counties mentioned above to register a heavy flow of gas above and in the oil zone.

Cochran Test Running High

Cochran County's lone active test is Bond, Harrison and Fogelson's Wm. Cameron 1, Labor 1, League 85, Greer County School Lands, 7 miles southeast of Morton, and it is credited with registering a high structural position in drilling to 3800 feet. Top of lime was called at 3760 feet, or 60 feet below sea level, and production is due about 800 feet below this level. Pete N. Wiggins, Ed. Hyde et al have made location for Slaughter 1, near center of Block 26, Lipscomb County School Lands No. 92, about 4 miles northwest of the Cochran County producer. The Texas Company also has an early drilling obligation on the Slaughter ranch.

Lease owners in vicinity of the two flowing producers in southeastern Yoakum County have agreed upon a development program that calls for 40-acre unit spacing. Upon the approval of this plan by the commission, the drilling of one test each is slated for Texas Pacific Coal & Oil Company, Honolulu Oil Corporation and Siosi Oil Corporation with locations spotted so as to explore outlying territory. Shell Petroleum Corporation's M. J. Mann 1, east offset to the Seminole area producer, Gaines County, was drilling near the 2500-foot level. Landreth Production Corporation's Cobb 1, fifth prospect for a one-well pool in southern Gaines County, has progressed beyond 4900 feet, and is conceded to be structurally low. Acreage to the southwest of the isolated producer is due to receive a 5500-foot test through the efforts of R. H. Gill et al in obtaining lease and cash contributions from nearby lease owners. Lou Wentz is reported to have assumed the drilling contract, and will drill P. W. Dalmont-Conoco 1, C NE SE Section 5, Block A-22, PSL Survey.

Delaware Basin Gets Attention

The Delaware Basin area is commanding a share of the exploratory work under way in West Texas. Barnett Petroleum Corporation, Dallas, has lately taken the lead among independents in assembling blocks, and is contracted to drill in Reeves and Loving counties. In the latter county, option

has been taken on 800 acres of the W. D. Johnson ranch, and a test will be drilled either in the NE¼ or SW¼ of Section 12, Block 56, T&P Ry. Survey, township 1, about 3 miles

WEST TEXAS

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
CRANE COUNTY (Wildcat)—		
Clark, Cooper & Smith, A. P. Jordan 1	90	3750
CRANE COUNTY (McCamey Field)—		
Superior Oil Co. (Cal.), E. S. Hughes 2	618	2252
CRANE COUNTY (Sand Hills Field)—		
Humble, J. B. Tubb 8	1030	4420
ECTOR COUNTY (Harper Field)—		
Honolulu Oil Corp.-W. A. Black & Son, E. F. Cowden 1-A	950	4332
ECTOR COUNTY (Goldsmith Field)—		
TP Coal & Oil Co., C. Scharbauer 2	1434	4267
ECTOR COUNTY (North Cowden Field)—		
Sinclair Prairie, M. Glass 1	565	4293
ECTOR COUNTY (Foster Field)—		
Broderick & Calvert, J. L. Johnson 2	780	4184
FISHER COUNTY—		
Gen'l Crude Oil Co., B. F. Willingham 8	127	3121
GLASSCOCK COUNTY—		
John I. Moore-Loffland Bros. Co. et al, McDowell 2, lse 2	848	2435
HOWARD COUNTY—		
Ambassador Oil Corp., C. D. Read 1-A	*	3258
Ennisbrook Oil Corp., Texas Land & Mtg. Co. 13	90	2796
Illinois Oil Co. (Herschbach), J. P. Davis 7-B	829	2840
PECOS COUNTY (Wildcat)—		
Hightower O&R Corp., J. M. Holmes 1	*	2633
PECOS COUNTY (Yates Field)—		
Ohio Oil Co., I. G. Yates 11-D	2400	1190
UPTON COUNTY (McCamey Field)—		
Cardinal Oil Co., Cordova Union 2-A	850	2228
Gulf Oil Corp., G. H. Rogers 4	562	2388
J. H. Shirk 8-E	218	2330
TP Coal & Oil Co., J. F. Lane 26-A	604	2035
A. A. Reese 7	789	2635
Weekley Oil Corp., Cordova Union 1	*	2082
WARD COUNTY—		
Atlantic Ref. Co., W. D. Johnson 25	537	2540
Bentley & Massey, J. H. Boogher 1-B (2½-ac)	158	2210
Gulf Oil Corp., Hutchings 70	1023	2748
Hutchings 71	1132	2741
Republic Prod. Co., C. R. Fox 7	*	2290
C. R. Fox 8	*	3459
Shell, S. S. Owens-Sloan 8	244	3030
Standard Oil Co. (Texas), B. D. Durgin 46	368	2530
Stanolind, W. H. Martin 3	38	2582
W. H. Martin 5	155	2937
TP Coal & Oil Co., M. Barker 9	789	2400
Tide Water Associated, Johnson 11	2916	2631
Johnson 12	1080	2624
Johnson 14	3240	2642
Wood & Schkade, J. H. Boogher 1	*	2560
WINKLER COUNTY (Eaves-Leck Field)—		
Harry Adams, Bradley et al, W. P. Edwards-Shell 5	93	3188
WINKLER COUNTY (Gulf-O'Brien Field)—		
Harry Adams-Hitchcock & Bradley, J. Sealy-Conoco 3	590	3142
WINKLER COUNTY (Halley Field)—		
Sun Oil Co., S. M. Halley 5	244	2961
WINKLER COUNTY (Henderson Field)—		
W. K. Royalty Co., Walton-Humble 4-B	7000	3041
WINKLER COUNTY (Kermit-Sayre Field)—		
Humble, W. A. McCutcheon 2	1007	3020
Navarro Oil Co., C. C. Crenshaw 3	1389	3130
Shell, Ida Hendrick 8-L	462	3079
Sinclair Prairie, H. E. Cummins 2-C	495	3050
TP Coal & Oil Co., Wahlenmaier Oil Corp., R. Clapp 2	682	3125
Nan-Tex Oil Corp. 1	459	3125
Tide Water Associated, Walton 13	945	2950

*Failures; †Junked; ¶Million cu. ft. gas.

northwest of flowing wildcat producer completed by Mason Oil Company last January at 3910½ feet. Barnett Petroleum Corporation has acquired an interest in J. C. Hill and Continental Oil Company's Ely 1, C NW Section 38, Block 71, PSL Survey, Reeves County Delaware test, and will drill with Diesel-powered rotary. The latter is on a 14,000-acre block, 9 miles southwest of Toyah. Grisham-Hunter Corporation's Charlotte Montgomery 1-A, NWc S½ NW Section 1, Wm. B. King Survey, 1 mile northeast of Toyah, cored lime and anhydrite, carrying oil stain, at 3645-3651 feet, and was drilling at 3755 feet, according to late reports. It has an elevation of 2891 feet.

Development of leases around Mason Oil Company's discovery in Loving County will likely assume important proportions later this year, unless contracted tests prove dry. Mason Oil Company's Minnie Kyle 3, SE SE NW Section 20, Block 55, township 1, west offset to the producer, was drilling at 2500 feet. Stanolind Oil & Gas Company has been delayed in starting a south offset to the completed well. Woodley Petroleum Company, Houston, recent purchaser of 4 tracts near this producer, contracted to drill on each lease, and is slated to drill the first test in the N½ of S½ Section 21, Block 55. Previously announced drilling obligation assumed by D. J. Finley and A. W. Cherry, Midland, for 640-acre lease out of the W. D. Johnson land will result in the immediate drilling of Johnson 1, NW NE SE Section 24, Block 56, about 1¾ miles west of the wildcat producer.

Crane County Show

In northern Crane County, Sinclair Prairie Oil Company has developed oil and gas showings in lime from the deepest of its two semi-wildcat prospects situated west of the Waddell field and southeast of the Judkins field, Ector County. This company's University 1-27, SE SE NW Section 12, Block 35, has cemented 7-inch pipe at 3271 feet after logging gas show at 3115 feet and oil and gas showings in lime at 3210-25 feet and 3260-65 feet. University 1-24, NE NE SW Section 13, Block 35, was drilling at 3210 feet. Gulf Oil Corporation's University 1-B, near SWc SE Section 11, Block 35, ¾-mile northwest of nearest production in the Waddell field, encountered gas showings below 3178 feet, and was drilling at 3419 feet, with an elevation of 3536 feet. The latter is registering a low structural position when correlated with nearest production. Clark, Cooper & Smith's A. P. Jordan 1, NEc Section 12, Block B-22, northern Crane County wildcat, has been assigned an initial rating of 90 barrels on pump after nitro shot and dual acid treatment in lime at 3590-3750 feet. It is about 3½ miles south of nearest production in the Judkins field, and probably on the same structure.

Eighteen Straight

The Foster field, Ector County, increased its total oil producers to 18 the past week through the completion of Broderick & Calvert's J. L. Johnson 2, SEc S½ SW Section 12, Block 43, T-2-S, flowing 780 barrels of 37 gravity oil initial after 450-quart nitro shot at 4060-4184 feet. No dry holes have been drilled in the area. York & Harper, Inc., and The Sloan-Zook Company's J. W. Buchanan-Sinclair 1, NWc Section 21, Block 42, T-2-S, is a new operation 2 miles east of the main section of the field, and 1½ miles southeast of the partnership's outpost producer. Sinclair Prairie Oil Company farmed out the 153-acre drilling site. Interest in the northeast portion of the North Cowden field has revived since the completion of Sinclair Prairie Oil Company's M. Glass 1, near SE NW SW Section 20, rated at 555 barrels initial after nitro shot at 4158-4293 feet. Top of lime was logged at 3800 feet, with an elevation of 3067 feet. Sun Oil Company has awarded rotary contract for O. B. Holt 1-C, SWc NW Section 20, on strength of the production of Glass 1. Humble Oil & Refining Company's T. J. Martin 1, idle producer on 130-acre lease and in NEc Section 38, Block 43, T-2-S, South Cowden field, has been acquired by J. L. Greene et al for $3500 cash, according to reports. This well was completed in 1934 with a small flow of oil and water after nitro shot and acid treatments, and has been inactive more than 6 months.

Gulf Oil Corporation's Crier-McElroy 24, an inside location on its large leasehold in Crane County, gauged 2755 barrels pipe line oil in 23 hours at 2847 feet, and was making 150 barrels per hour when closed in for lack of tankage. This concern's W. N. Waddell et al 4, third Ordovician lime project for the north end of the Sand Hills structure, Crane County, was drilling at 5860 feet late last week, and is checking higher structurally than the two previous deep oil producers.

Atlantic Refining Company has acquired lease protection around two contracted deep tests near a wildcat gas and distillate well in Schleicher County. The former paid $25 per acre for lease on four 80-acre tracts near John M. Cooper et al's Bert Page 2, C NE SE Section 40, Block L, GH&SA Ry. Survey, and paid $6400 cash for lease on four 160-acre tracts near Tex-Tor Oil Corporation's contracted 6000-foot test in SW½ Section 33, Block A.

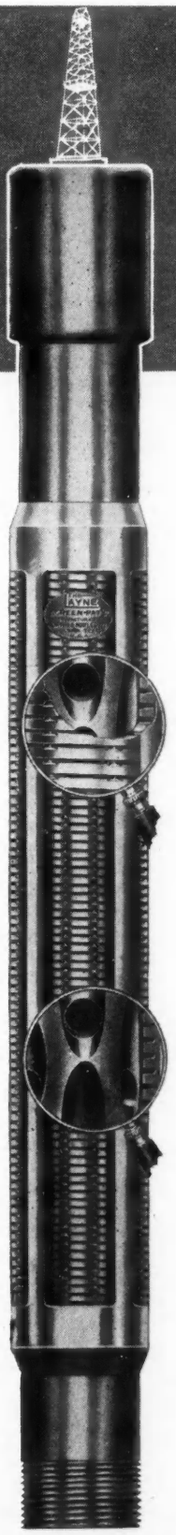
Semi-Wildcat Produces

Pampa.—Semi-wildcat oil strike on the south flank of the Panhandle ridge was credited the past week to Empire Oil & Refining Company's J. Stephens 1, near NW NW SW Section 187, Block B-2, H&GN Ry. Survey, west central Gray County. The well filled 2000 feet with high gravity oil from granite wash formation at 3106-08 feet and 3145-3161 feet, and shut down to erect storage. It is 2 miles north by east of F. W. Dillard et al's Furneaux 1, which made 10,000,000 feet of gas with 20-barrel spray of oil at 3074-80 feet in December, 1929. The latter was later deepened to salt water at 3234-3475 feet, and made 60 barrels oil when plugged back to 3215 feet. Phillips Petroleum Company acquired Furneaux 1, and in March, 1933, worked over the well for a natural flow of 80 barrels daily. Development of the area has been retarded by the absence of a pipe line outlet.

H. C. Robertson et al have started operations on S. T. Morgan 1, SEc Section 35, Block A-4, H&GN Ry. Survey, north central Wheeler County wildcat

GREATER STRENGTH

of WIRE WRAPPED SCREEN *protects well investment*



Screen, setting at the bottom of a well, must sustain a terrific weight. Above it rests a huge investment in tubing, liner, etc.

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is made with any size or kind of pipe from 1″ to 16″ in diameter. It is perforated in vertical staggered rows without causing any appreciable weakening of the pipe.

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THE LAYNE WIRE WRAPPED SCREEN

on a 19,000-acre block. The acreage was assembled last June, and plans call for the drilling of a 4000-foot test. Phillips Petroleum Company's G. W. Porter 1, C NE SW Section 35, Block A-8, H&GN Ry. Survey, Wheeler County wildcat on the north flank of the ridge, has been abandoned at 7142 feet. It was seeking production in the Ordovician lime section.

Phillips Petroleum Company is actively engaged in purchasing partially developed oil properties in Hutchinson County for the purpose of building up its crude supply for use in its Borger refinery. Cash consideration of $55,000 is reported to have been paid by the company for Lone Star State Drilling Corporation, Pampa, et al's Ed. Moore 80-acre lease, embracing the N½ SW¼ Section 22, Block M-21, T. C. Ry. Survey, with one well rated at 637 barrels potential. This well is prorated to 34 barrels daily. Phillips Petroleum Company recently purchased Power Petroleum Company's J. T. Hodges and R. A. Starnes leases and G. N. McDaniel, Borger, et al's J. T. Hodges lease, aggregating 200 acres and 4 pumpers, for $70,000 cash; $40,000 payable from oil production; and the buyer assumes outstanding oil payments that amount to about $45,000.

Stephens Interest Renewed

Breckenridge.—Renewed interest in deep line development in eastern Stephens County has resulted from the discovery of prolific gas production by Russ Petroleum Company, Clark-Cowden Drilling Corporation and W. T. Garrett's Mrs. A. Echols 1, SW Section 10, Block 3, S. P. Ry. Survey. The well tested 16,800,000 feet of gas at 3856-69 feet in Marble Falls horizon, and last week recovered oil sand when cable tool core barrel was used at 3878 feet after partially mudding off the gas flow. Owners are attempting to lower casing to cut off some of the upper gas and test for oil production. The semi-wildcat strike is on a 1440-acre drilling block. Jack Greenwood et al have contracted to drill to the same horizon on a block adjoining to the north.

TEXAS PANHANDLE

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
CARSON COUNTY—		
Magnolia, Fee (244) 22	796	2997
Carl M. Smith et al, J. M. Gorenflo 1	¶55.4	2583
GRAY COUNTY—		
British-American Oil Prod. Co., Alex Smith 1	581	3240
Doniphan O&G Co., T. B. Cobb 2	453	3381
Magnolia, C. S. Barrett 5	273	3298
Texas Co., W. W. Harrah 11	528	3240
HUTCHINSON COUNTY—		
Phillips Pet. Co., Cockrell Ranch 17	736	3078
J. B. Lucas 1	¶24.6	3214
Skelly-Henry L. Cabot, Henry Yake 1	¶18.5	2965
Turman Oil Co.-Plains Pet. Corp., Whittenburg 5-B	794	2736
HANSFORD COUNTY (Wildcat)—		
L. S. Hobbs Oil Co., J. P. Pearson-Hitch 1	¶5.1	2864
WHEELER COUNTY—		
Phillips Pet. Co., G. W. Porter 1	*	7142

*Failures; †Junked; ¶Million cu. ft. gas.

Kansas

[*Continued from page 109*]

from the conglomerate at 3364 feet, based on a six-hour test, during which time the well flowed 300 barrels of oil.

Ohio Oil Company's Wood 1, NW NE NW 3-20s-10w, southeast of production in the Schartz sector of the Silica pool of Rice County, pumped 398 barrels of oil and 60 barrels of water on a potential test from the Siliceous lime at 3359 feet. Gulf Oil Corporation's S. Wendell 4, SEc 32-19s-10w, was completed for 1186 barrels of oil following acidization in the Siliceous lime at 3291 feet. Skelly Oil Company's Dittmers 2, SWc 28-19s-10w, at the northwest edge of the pool, was completed for 2334 barrels of oil from the Siliceous lime at 3275 feet following acidization. Gulf's Meda Steckel 1, SE NE NE 31-19s-10w, was completed for 1115 barrels of oil after being acidized in the Siliceous lime at 3286 feet.

Saco Oil Company and Quivira Oil Company's Sharpe 1-A, NEc NE SE 13-20s-10w, on the discovery lease in the Sharpe sector of the Chase pool, had 1000 feet of oil in the hole from the Siliceous lime at 3333 feet. Tubing was being run to acidize before making a test of production. The new producer is one location north of the Sharpe discovery well of the Marleen Oil Company, since pumped out and abandoned.

NORTH TEXAS

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
ARCHER COUNTY—		
Golding & Cochran, B. R. Jeske 8, sec 6	10	1189
Terrapin School-G. B. Hamilton 1, sec 6	15	1194
J. A. Selph et al, Gus Symank 1, blk 11	*	1430
J. G. Steele et al, G. A. Kay 1, blk 2	*	1504
United Producers Co., J. J. Speer 1, blk 14	*	801
Van Wormer & Boller, Falls County 3, blk 62	25	1177
BAYLOR COUNTY—		
W. J. Grisham et al, W. H. Portwood 1, sec 1279	*	1450
COOKE COUNTY—		
The Texas Co., J. W. Hess 1	3	1003
JACK COUNTY—		
Cato Oil Co., J. A. Raley 1	520	3065
S. B. Edwards et al, S. F. Williams 1	*	3556
Gillespie & Perren, L. J. Hester 3	100	3024
Hamilton Pet. Co., A. B. Kuykendall 5	35	3056
Hill & Hill, S. M. Jones 3	125	3036
Tom C. Patton, Inc., J. M. Taylor 1	75	3035
O. J. Perren et al, J. R. Clayton 6	495	3025
MONTAGUE COUNTY—		
Raizen Bros., W. W. Jones 7, blk 23	13	837
The Texas Co., Cunningham 14-A	30	912
WICHITA COUNTY—		
Bridwell Oil Co., W. B. Honaker 3	18	1060
L. T. Burns et al, Waggoner Bros. 19, blk 32	*	1540
C. W. Clark et al, Allen-Kemp 8-B, blk 44	12	1262
Coleman & Coppock, G. R. Hodge 8-A, blk 39	8	853
C. R. Conyers et al, G. Jennings 1, sec 8	†	1736
King Oil Co., S. B. Burnett 1-B, sec 3	*	2003
Waggoner Est. 16-H	30	1566
Waggoner Est. 2-R	27	1425
W. B. Omohundro et al, S. P. Gibson 5-B, blk 302	100	1918
H. L. Rugeley et al, Waggoner Est. 13, sec 148	150	1975
A. B. Wharton, Jr., Waggoner Est. 7-B	20	1997
WILBARGER COUNTY—		
Perry Oil Co., Inc., J. C. King 1	*	2162
YOUNG COUNTY—		
Paul Atchley et al, B. F. Haygood 1, sec 1369	*	1005
Dick Duncan et al, J. P. Atchley 1, sec 226	*	1038
A. Kriss et al, Belknap Coal Co. 1, sec 22	*	707
R. H. Vise et al, Norton 1, sec 615	2500	3856
Worth Oil Co., F. M. Cullers 19, blk 19	*	605

*Failures; †Junked; ¶Million cu. ft. gas.

Recover Lost Tools

John B. Hanna et al's Fulton 1, NWc NE 24-19s-6w, recovered a string of tools lost in the hole at 2250 feet and was running a string of casing to shut out water intrusion before drilling ahead.

Gulf Oil Corporation was experimenting with acid at Gossman 1, SWc NW SE 8-21s-7w, the first well to be acidized in the Hauschild, which produces from the conglomerate. The well was acidized with 1000 gallons after it had swabbed only 2½ barrels of oil an hour from the formation at 3377 feet. It will be allowed to set for two days before the hole is unloaded and a test made.

Sinclair Prairie Oil Company's Proffitt 3, NE NW NW 3-20s-10w, in the Schartz sector of Silica pool, pumped 1437 barrels of oil and no water from the Siliceous lime at 3332 feet.

Roy Ramsey's Malone 1, NWc NE 1-20s-10w, west of production in Chase pool, was abandoned last week. Top of the Siliceous lime was found at 3300 feet, but the hole filled with sulphur water before drilling ahead three feet. It was the first attempt to test the west flank of the seven-mile trend of the Chase pool.

National Refining Company's Sherman 8, SE NE SW 16-19s-1w, in the Beyer sector of the Chase pool, filled 500 feet with oil in four hours from the Siliceous lime at 3230 feet. It was being tested.

Rosespring Drilling Company's White 1, NEc SW 5-32s-1w, the farthest south well in the Wellington pool of Sumner County, boosted production considerably on a retest. It pumped 487 barrels of oil from the chat at 3690 feet following acidization.

Watching Harper County Test

A closely watched test is Carter Oil Company's Seibert Estate 1, CSW NW 4-34s-8w, a wildcat southwest of Anthony in Harper County which was reported to have found top of the Kansas City lime at 4086 feet, and was drilling ahead below 4153 feet with nothing showing. The well is several miles from oil or gas production.

Gulf Oil Corporation's Mary Grizzell 2, NW SW NW 31-17s-10w, in the Ellsworth County sector of Bloomer pool, filled 3000 feet with oil in 45 minutes after drilling out the plug at 3258 feet in Siliceous lime. In a six-hour swabbing test, the well made 560 barrels of oil. At no time during the swabbing test was the fluid lowered below the 2000-foot level. It is the second producer for the company in the area. Grizzell 1 was drilled in more than a week ago, but a potential test will not be taken until pipe line connections have been completed.

Houston County wildcat indicates new oil field

* * *

Talco output at highest peak with 225 producers

Palestine.—Sufficient oil and gas appeared with salt water when formation tester was used on Placid Oil Company et al's J. E. Elliott-Shell 1, northeastern Houston County wildcat, to indicate that a new producing area is in the making. In the event an oil field materializes it will be an important south extension for oil production from the Woodbine zone in the lower East Texas Basin. Drill-stem test made April 1 at 5879 feet, or 5508 feet below sea level, with packer near top of sand at 5870 feet, yielded 4 joints of high-gravity green oil and about 400 feet of salt water. One quarter-inch chokes on tester were open 15 minutes. Gas production was estimated at 1,000,000 feet daily, based on the brief test. Water is believed from last 3 feet of formation penetrated, as it cut like soft sand with core barrel but could not be recovered. Pipe will probably be cemented at total depth, and gun-perforated opposite top of the sand section.

Result in More Work

Preliminary showing made by the test on the Elliott tract, which is about 6 miles northeast of Grapeland and on 200-acre site included in leaseblock farmed out by Shell Petroleum Corporation for the drilling of a Woodbine test, will result in further exploration work in the area. Location is near center of west 40-acres of the south 200-acres of the Elliott fee, and in Juan M. Procella League. The area has been rated as an attractive geophysical prospect for several years. Placid Oil Company is controlled by H. L. Hunt, Tyler.

American Liberty Oil Company et al's J. A. Bean 1, second test for the Grapeland gas and distillate area, drilled to 6300 feet to complete contract, and has cemented 5½-inch casing to complete as a gas and distillate producer in Woodbine topped at 6018 feet, or 5529 feet sub-sea. First water sand was logged at 6089-95 feet.

Tide Water Associated Oil Company and Seaboard Oil Corporation's Monnig 7, first Trinity test for the Long Lake field, Anderson County, was standing by for drill-stem test late last week at 8642 feet, with an elevation of 233 feet, after failing to make recovery on core tests. It is in the lower Glen Rose, and near the projected oil or gas zone. Top of anhydrite was logged at 8343 feet. The above partnership in association with Humble Oil & Refining Company is making a Trinity test on the McElreath-Suggett tract, Opelika structure, Henderson County, and logged top of Paluxy at 6038 feet. Tom F. Hunter and American Liberty Oil Company's Gage 1, Blackfoot structure, northern Anderson County, logged top of Paluxy at 6758 feet and first Glen Rose at 6914 feet, with an elevation of 384 feet, and was drilling in lime and shale at 7550 feet. Humble Oil & Refining Company's Riggs 1, northeast Van deep test, was drilling at 3700 feet.

Pure Oil Company's Kendrick 16, projected deep test for the Mexia field, has not resumed drilling since cementing pipe at 405 feet. J. Edward Mills et al's Sam Grucholski 1, located about 5 miles southwest of Kosse and in Falls County, was drilling at 5265 feet, logging lime and shells for the past 100 feet. It is seeking production in the lower Glen Rose section of the Trinity.

Talco Output at Peak

Talco, Texas.—Production at Talco advanced to a new peak during the week ending March 29 with a daily average yield of 23,200 barrels from 255 pumping and flowing wells. Humble Pipe Line Company transported 12,864 barrels daily during this period through its trunk line, and the remainder was diverted to tank car shipments, local refineries and storage. Allowable of the field was due to be cut back to 19,169 barrels daily effective April 1, and several months will elapse before new completions restore production to the record level.

Crude market situation at Sulphur Bluff, which also produces low-gravity oil from the Paluxy zone, was clarified the past week when Big State Oil Corporation, Houston, began making deliveries through its 8-mile 8-inch line to a tank car rack at Saltillo. The oil will be moved in tank cars to a Houston terminal.

Walter Goldston and Big State Oil Corporation's H. J. Smith 12, east outpost for the Sulphur Bluff field, gauged 704 barrels potential on ¼-inch tubing choke from Paluxy section at 4494-4528 feet with an elevation of 429 feet. It is one of the largest producers in the field. Hager, Luse and Russ Petroleum Company's Pierce 1, near south line of production, cored good body of sand in section at 4468-4517 feet, with an elevation of 427 feet, and was due for completion late last week. Hager and Luse's Reynolds 4 north offset to the first producer on this 200-acre lease, logged oil saturation at 4488-4513 feet, with an elevation of 424 feet, and is also due for early completion. It is close to the fault plane.

EAST TEXAS

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
JOINER AREA—		
Amerada & Deep Rock Oil Corp., Stovall 30 (193.86-ac)	3000	3636
Davis & Hart, W. B. Perry 3-A (80-ac)	1500	3662
Humble, S. A. Plowman 49-A (228½-ac)	8000	3697
M. A. Kline & Powers, M. Lee 6 (37.2-ac)	4200	3651
P. G. Lake, Inc., Joe Lee 6-A (43.58-ac)	6000	3773
Ohio Oil Co., S. H. Moores 41 (200-ac)	2500	3720
Ortiz Oil Co.-Staley Oil Co., H. M. Hale 10 (40¼-ac)	100	3750
W. L. Pickens et al, A. L. Towns-London lot 1	7200	3818
Stanolind-Pure, W. H. Siler 72 (983.53-ac)	180	3679
Sun Oil Co., E. Seale 1 (71.6-ac)	1000	3715
The Texas Co., Cora Hanna 6 (20-ac)	4000	3650
Texokana Oil Co., H. Kersh-Ohio 4 (46-ac)	*	3645
J. S. Wheless Oil Corp., I. J. Smith-Gulf 14 (92.2-ac)	7200	3699
KILGORE AREA—		
Adams & Lyles-Coffield, M. Jackson 3 (16.66-ac)	3500	3668
Geier Bros.-F. B. Jackson, M. E. Minor 5 (30½-ac)	7200	3730
Burwyn Oil Corp., E. B. S. Florey 7 (50-ac)	550	3675
Hawkins & Howell, M. Strong 1 (91-ac)	500	3617
Luling O&G Co., W. P. Brightwell 6-B (21.9-ac)	8600	3640
Alex McCutchin et al, J. S. & F. Elder 3 (20-ac)	3800	3620
John F. Merrick-J. B. Apperson, I&GN Ry. Co. 3 (9-ac)	120	3690
Sun Oil, Hilburn-Loyd 27 (133.7-ac)	1000	3637
Sun-Seaboard Oil Corp., M. T. Cole 46 (266.17-ac)	6500	3537
LONGVIEW AREA—		
Amerada Pet. Corp., L. R. Hearne 14 (107-ac)	4000	3520
Arkansas Fuel Oil Co., M. D. Allison 12 (59½-ac)	10,400	3606
Day & Co., B. Victory 8 (40.2-ac)	3600	3627
Gulf, J. C. Judge 83 (518.3-ac)	9600	3532
Magnolia, H. Hampton 25 (153.33-ac)	7800*	3610
G. W. Tate 8 (67.58-ac)	7500	3452
E. P. Pewitt et al, H. B. Owens 1 14.4-ac)	1500	3736
Rancho Oil Co., W. E. Bumpass 6 (14¾-ac)	8400	3573
Shasta Oil Co.-Pet. Finance Corp., Campbell 10-A, (56¼-ac)	8000	3604
Sinclair Prairie, W. H. York 18 (86.45-ac)	7000	3568
Southland Drlg. Co.-United E&W Oil Co., O'Byrne 45 (304-ac)	2000	3632
Stanolind, F. K. Lathrop 23-B (63.68-ac)	5000	3569
J. C. McKinley 50-B (60-ac)	5500	3633
Stanolind-Tide Water, F. M. Fonville 12 (100-ac)	8200	3560
Tide Water Associated, E. M. Nettleton 15-A (148¾-ac)	4000	3534
Sam K. Vierson et al, O. M. Victory 7 (25-ac)	6000	3644
J. K. Wadley et al, Gillespie 2-B (40-ac)	750	3747
FRANKLIN COUNTY (Talco Field)—		
L. S. Flannery, Inc., J. L. Hedrick 2 (65-ac)	500	4265
HENDERSON COUNTY (Cayuga Field)—		
W. H. Goodnight et al, C. R. Litchfield 1 (10-ac)	50	4097
Roeser-Pendleton, Inc., Ben H. Wathen 2 (93-ac)	3000	4104
TITUS COUNTY (Talco Field)—		
K. & A. Oil Co., K. Moore 1, c n½ lot 2, blk 33	240	4345
Nugent Hrs. 1, c lot 2, blk 41	288	4300
Magnolia, C. M. Carr 6 (70-ac)	271	4285
CASS COUNTY (Rodessa)—		
Frank De Mayo, Chew 1, Robert Trammell sur	148	6010
R. W. Norton, Davis 1, H. Holbert sur	314	6010
Davis 2, H. Holbert sur	288	6000
United Prod. Corp., Clement 1, W. B. Hughes sur	288	6080
Bibby 6, Alex Archer sur	264	6050
HARRISON COUNTY (Waskom)—		
Geyer Oil Co., Alex Moore 1, C. W. Field sur	17	2452

*Failures; †Junked; ¶Million cu. ft. gas.

Lower Coast records discoveries and extensions

* * *

One new field and one new sand in Starr County

* * *

Deal involves 150,000 acres on Chittim anticline

Corpus Christi.—South Texas Gulf Coast contributed wildcat discoveries galore during the week as new sands, fields and key extensions were reported in practically every county in the district. It was one of the most outstanding weeks for this zone since the beginning of the hot play two years ago.

Jackson County Strike

Deveopment lead off with The Texas Company apparently discovering a Marginulina sand area five miles southeast of Ganado in Jackson County. This discovery is the first wildcat drilled in Jackson County following a hot leasing and geophysical campaign started recently and greatly increases the heat on this project. T. N. Mauritz 1, southeast corner, a 210-acre tract, Morris and Cummings Survey, Abstract 305, cored sand and broken sandy shale and sand from 5085-5112 feet. On a series of drill stem tests the well showed both oil and gas from 5081 feet to bottom. The last test, from 5089-5112 feet, developed 135 feet of mud and oil, 50 percent of which was 26 gravity oil, with 355 pounds working pressure through quarter-inch chokes, top and bottom, in seven minutes. Casing was being run for completion. The test, drilled by Trinity Drillers, Incorporated, of San Antonio, topped Discorbis at 4480 feet and Marginulina at 4930 feet.

May Extend Mauritz

Shell Petroleum Corporation was completing a Jackson County wildcat, T. N. Mauritz 1-B, nearly a quarter mile northeast of the discovery well of Mauritz field. The test drilled to 5704 feet, plugged back to 5660 feet, perforated at 5657-58 feet and was testing. If a producer, it will be the second for the Frio sand field. Previous extension attempts failed to meet with success.

Find New Deep Zone

Aransas County took a front position in importance with Buckingham Oil Corporation and Edwin M. Jones' McCampbell 2-B finding 80 feet of sand from 7320-7400 feet and setting casing for completion. This sand section is 800 feet below Marginulina production in the area and is in the Frio zone. The well failed to find the regular McCampbell field sand, despite the fact that it was an offset to a producer, and was drilled to 7546 feet. Part of the sand section was cored, showing distillate and heavy gas pressure from 7320-35 feet, oil to 7351 feet. Two cores immediately below this were only partially recovered, but they showed saturation. After reaching the total depth, an electric formation tester was run, following which casing was set to 7440 feet. It will be gun perforated for tests.

The above discovery, if successful, will lower the producing level in the general area another 400 feet. Saxet's 6900-foot production is at present the deepest commercial oil. Barnsdall Oil Company's Kate Edwards 1, on Lamar Peninsula, also Aransas County, is flowing some gas, oil and water through stuck drill stem at 7998 feet, but this cannot be classified as a commercial producer. An offset, Edwards 1-A, being drilled to test the same sand, is fishing at 6315 feet.

Two Victoria County Extensions

Two extensions in Victoria County were provided Frio sand fields, while another test was attempting to open a new producing level. Commonwealth Oil and Gas Company (George H. Echols) was running casing in W. H. Bennett 3 after a drill stem test from 5464-76 feet developed 450 feet of oil and mud under 75 pounds working pressure through quarter-inch chokes, top and bottom, in 4½ minutes. A 675-foot water cushion was used on the test. The well topped a sand series at 5415 feet, ground elevation being 54 feet. This well, located in the J. E. Galban survey, is one mile north of Heyser field, Calhoun County, and several hundred feet across the county line into Victoria County. It takes the field out of the "controlled" class and paves the way to a rather extensive development campaign.

Keeran Outpost Successful

Union Oil Company of California also was a successful wildcatter, C. A. Keeran 3, one-half mile southeast of Keeran 2, present southeast outpost producer in Keeran, Victoria County, drilled to 6005 feet, set casing on bottom and will perforate a section at 5695-5704 feet which showed 1600 feet of oil and 65 pounds working pressure on a 10 minute drill stem test. The sand section continued several feet below this level.

Magnolia Petroleum Company was establishing a new producing horizon on Telferner prospect, also Victoria County, with Annie B. Wagner 1, Section 1, about 660 feet south of Beck 1. Drilled to 4240 feet, the well was plugged back to 2590 feet and perforated at 2517½-19½ feet, but a drill stem test showed 220 pounds pressure with 30 feet of oily mud in 10 minutes. Another perforation job will be attempted in an effort to establish oil production.

San Patricio Discovery Looms

Phillips Petroleum Corporation's Henry Schmidt 1, Section 81, four miles northwest of Gregory in San Patricio County, is looked upon as the discovery well of the next oil field for Frio sand in this district. The well has approximately 7,000 feet of casing on the ground and is drilling ahead to that level. The pipe will be set for a test of a sand series already encountered. Top of the sand section, not definitely determined, is just below 5300 feet. Poor recovery was obtained in cores between 5318-39 feet, but a drill stem test of this apparent sand section resulted in 425 pounds working pressure with 100 feet of oily mud in 3½ minutes. At last reports, the well was below 6350 feet. Gregory area has been in the limelight for months, but very poor results have been obtained on the several wildcats drilled.

Nueces County's discovery of the week was Wellington Oil Company's Clara Driscoll Sevier 14, William Gamble Survey, in the Clara Driscoll field. The well drilled to 5423 feet in sand topped at 5425½ feet. The result was a gas and distillate well, flowing through one-eighth inch choke under pressures of 1600 and 1800 pounds on tubing and casing, respectively. No gauge has been made. Magnolia Petroleum Company's Sevier 2, developed 850 feet of salt water at 5439-42 feet, the same sand, and is drilling below 5515 feet.

New field, new sand in Starr

Mission.—One new field was opened and another received a new producing horizon in Starr County to feature Rio Grande Valley activity during the week. G. E. Dodd et al's B. D. Wood Estate 1 flowed at the rate of about 32 barrels per hour on short tests through 5/16-inch choke from sand at 1739-54 feet to open El Tanque field. The oil, coming from the Frio, is 31 gravity.

Second Sand for Ricaby

Ricaby pool received a second sand when Moss & Heard's S. B. Ricaby 3, Porcion 83, and 300 feet east of the discovery well, flowed about 2 barrels of oil per hour through 3/16-inch choke from 1602-11 feet, also in the Frio. The pressures were 235 pounds on the tubing and 425 pounds on the casing. The other sand in the field is at 1325 feet and is productive in only one other well.

K. E. Merren's Starr County Cattle Company 1, Block 34, Porcion 89, Barbacosa area, finally has been controlled after pumping several thousand sacks of commercial mud into the formation at 5377-81½ feet, from whence the well has been attempting to blow out for about a week. The Cockfield sand has shown gas in several other wells in the

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area, and efforts will be made to find saturation in the lower portion of it in subsequent cores.

Gulf States Oil Company's Engelman 3, 8110-foot test in Mestinas field, Hidalgo County, plugged back to 6700 feet after testing salt water through perforations at several levels below this point, and perforated again at 6690-93 feet, where it again swabbed salt water. It is waiting on orders, but likely will perforate above.

Sterling to Set Casing

Several miles southeast of Mestinas and in LaBlanca area, Sterling Oil & Refining Company has casing on the ground at Engleman 1 to run after completing coring the 8000-foot sand in which it was April 1. Screen will be set in the bottom sand, although this Hidalgo County wildcat cored 30 feet of sand at 6630-60 feet, colored distillate and gas in a sand at 7490-7550 feet, saturation and gas 7840-7902 feet. A 9⅞-inch bit is being used.

Shell Petroleum Corporation was coring ahead below 8445 feet in Yturria 1, deep test in La Sal Viejo, Willacy County.

Big Lease Deal

San Antonio.—Further impetus was given to the deep Chittim anticline play of South Texas through acquisition of another 150,000 acres of leases by a single company. The deal, announced during the week, was between Rycade Oil Corporation and Wellington Oil Company of Delaware and the latter company acquired commercial leases on all of the 195,000-acre J. M. Chittim block in Maverick, Zavalla and Dimmitt Counties, except for the 45,000-acre block surrounding the Chittim gas field, producing from below 5500 feet in the Glenrose formation.

The Wellington concern, with headquarters in San Antonio, recently took a commercial lease on the 93,650-acre Sullivan ranch in the same three counties, and joining into the newest purchase to form a solid block of nearly a quarter million acres. The company plans extensive geological and geophysical survey, following which at least one deep test is to be commenced before the close of the year.

Several Preparing to Drill

This deal is one of many during the past several months by both major and independent companies through this trend, apparently in an effort to control the very large reserve believed to be located on this northwest-southeast trend. Several wells are preparing to commence and others are being planned. Diamond Halff Oil Company recently turned considerable acreage in northwestern Dimmitt County to Paul Teas for a 7,000-foot test. Porter and Connor also are to commence a well soon in the same general area. In the southeastern portion of Dimmitt County, Wilcox Oil & Gas Company is drilling at a shallow depth on its first of four proposed 7,000-foot tests to be drilled on the Light Ranch in the corner of Dimmitt and LaSalle Counties.

Amerada Petroleum Corporation is below 8225 feet in Halff and Oppenheimer 8, projected 10,000-foot well in Pearsall, Frio County. It has had a number of shows of both oil and gas and is credited with the discovery of Edwards limestone production for this area. The same company was near 5500 feet in D. D. Harrigan 1, wildcat several miles southwest of the same field.

Several wildcats are testing minor shows of both oil and gas in Atascosa, Guadalupe, Caldwell Counties, but none promised to open large producing areas. The key well along the upper Balcones Fault Zone at this time is Diamond Halff Oil Company's Bibbs 1, on the west side of the Darst Creek field, Guadalupe County. Late in the week it was drilling below 4236 feet in hard Glenrose limestone.

SOUTH TEXAS

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
LAREDO DISTRICT		
DUVAL COUNTY—		
Argo Oil Corp., V. Rodriguez 1, 330 ft nel, 1849 ft sel of se¼ sur 498, 1800 ft w Argo & Clopton No. 2 Smith-Corkill	*	3035
Coffield and Lanning, H. J. Ritter 1, sur 73 (Loma Novia)	*	2648
Cox and Hamon, J. B. Peal 8, sur 796 (Lopez)	356	2194
Duval Oil Corp., W. K. Hoffman (Sophie) 11, sur 124 (Hoffman)	250	2869
C. K. Gravis, Jr., Christina Holzapfel 1, 1875 ft westerly wl, 460 ft northerly sl of J. Poitevent sur No. 42, extreme nw cor of county	*	2539
Humble Oil and Ref. Co., DCRC 9-C, sur 901 (Lopez)	250	2140
Humble Oil & Ref. Co., M. C. Hubberd 19-A, sur 84 (Loma Novia)	300	2818
M. C. Hubberd 14-B, sur 83 (Loma Novia)	850	2768
Violet Kohler 55-A, sec 164 (Kohler)	20	2636
Magnolia Pet. Co., DCRC 13, sur 100 (Piedre Lumbre)	325	1978
DCRC 14, sur 100 (Piedre Lumbre)	325	1990
S. E. Harville 6, sur 64 (Gov't Wells)	7	2514
Emma Herbst 13, sur 70 (Loma Novia)	40	2743
Mortimer & Springer, J. B. Peal 28-B, sur 794 (Lopez)	725	2191
Smith & Hamill, G. Ruiz Est. 4, sec 41 (Loma Novia)	200	2594
The Texas Co., Bishop Cattle Co., 22, sur 57 (Loma Novia)	435	2572
Wellington Oil Co., DCRC 8, sec 53, (Colmena)	¶6,	1392
JIM HOGG COUNTY—		
Gifford Oil Co. & Locke Purnell, E. L. Armstrong 1, 330 ft el, 1650 ft sl of sur 43, 320-ac tr, 5 mi ne Randado	*	4358
McMULLEN COUNTY—		
Comet Oil Company, H. L. Lark 3, E. W. B. Scrugham sur (Calliham)	30	1038
STARR COUNTY—		
G. E. Dodd (Holland Wood) B. D. Wood Est. 1, 330 ft e of wl center 3/7 of Portion No. 84, Camargo Juris. 1000 S. Jeffries-Lambeth field pipeline to Rio Grande City, 4½ mi ne Rio Grande City.	850	1754
Moss & Heard, S. B. Ricaby 3, 571 ft e of w½ por 83, J. of Camargo and 23,700 ft n State Hiway No. 4	90	1611
WEBB COUNTY—		
O. W. Killam, Fee 1, 330 ft nl, 1422 ft wl, blk 1, sur 1690	*	5245
C. H. Lewis, A. Lopez 14, sur 110 (Lopez)	500	2266
Mortimer & Springer, Josefa L. Valadez sur 73 (Lopez), perf 2146-52	475	2155
Joe Palmer, Laredo Nat'l Bank 1, 1980 ft wl, 1980 ft sl sur 463	*	2427
Smith & Hamill, S. Benavides 1, blk 497 (Cole-O'Hern)	325	2947
S. Benavides 2, block 456 (Cole-O'Hern)	650	2942
Sun Oil Co., S. Benavides 5, block 377 (Cole-O'Hern)	138	2950
ZAPATA COUNTY—		
Mills Bennett Prod. Co., F. B. Martinez 1, 260 ft nwl, 260 ft swl, blk 84, sh 1, El Grullo gr	*	2505
Earl Callaway, Belen Bustamante 2, sh 8, Fansler Part. (Escobas)	76	1227
Justina Garcia 4-A, sh 3 (Escobas)	¶2 & 10	1052
Dan Auld et al, Gopher Trust Est. 1, 630 ft nel, 520 ft sel blk 9, sur 6, Fullerton sub	*	1335
Magnolia Pet. Co., Gonzales-Cuellar 1, 3969 ft nwl, 2457 ft swl of Cuellar tr, Cerrito Blanco gr	¶15	1116
A. D. Haynes 24, sur 7 (Comitas)	40	1137
A. D. Haynes 25, sur 7, (Comitas)	40	1150
Valley Osage Oil Co., A. D. Haynes 15, sur 14 (Comitas)	35	1160
SAN ANTONIO DISTRICT		
BEXAR COUNTY—		
Jim Beard, Juan Baragon 3, James Simpson sur (Von Ormy)	3	650
J. H. Devine et al, Joe Miholski 1-A, 592 ft el 100-ac tr, 1171 ft sl sur and tr, Jose M. Bustillo sur 29	*	521
Roger Putman, Simon & Anna Wetz 6, J. S. Simpson sur (Von Ormy)	5	667
Shaddrock Oil Co., Juan Barragon 8, J. S. Simpson sur (Von Ormy)	2	670
CALDWELL COUNTY—		
C. F. Richards, Baptist Church 1, J. R. Miller sur (Branyon)	65	2230
GONZALES COUNTY—		
Victoria Dr. Co., T. G. Edwards 1, 150 ft nl and wl of blk "B", Holliday subd	*	1712
GUADALUPE COUNTY—		
La Jita Corp., Dan Denman 3, Wm. Arrington sur (South Darst Creek)	450	2438
MEDINA COUNTY—		
Charles H. Wagener, Medina Irr. Farms 17, blk 1 (Chicon Lake)	1	326
WILLIAMSON COUNTY—		
B. E. Pierce, C. Matteck 4-A, H. White sur (Byersville)	100	885
C. R. Richardson, E. Zeischang 1, H. White sur (Byersville)	*	1002
GULF COAST DISTRICT		
ARANSAS COUNTY—		
Atlantic Ref. Co., McCampbell Ranch 4-B, sec 8 (McCampbell)	650	6550
Buckingham Oil Co., McCampbell Ranch 4-A, blk 41 (McCampbell) perf 6540½-44½	475	6550
BROOKS COUNTY—		
L. & W. Oil Co., William Singer 1, sur 436 (Alta Verde)	*	948
Standard Oil Co. of Texas, Brulia Garcia (tr 1) (Alta Mesa)	200	2566
HIDALGO COUNTY—		
Ralph E. Fair, Inc., A. Flores 2, por 38 (Samfordyce)	425	2962
JIM WELLS COUNTY—		
Baltic Dr. Co., G. W. Owens 1-A, 585 ft s of se cor Frank sur 152, in Poitevent sur	*	6018
Richardson, Ware & Richardson, B. Miller 1, sec 76 (Premont)	350	2336
KLEBERG COUNTY—		
Great States Oil Corp., V. J. Kivlin 1, sec 39 (Kingsville)	*	2440
LAVACA COUNTY—		
Willshire Union Oil Co., Albert Pohl 1, 330 ft northerly sl, 330 ft el of 120-ac tr, M. Wooten sur	*	3135
LIVE OAK COUNTY—		
R. A. David et al, Border Nat'l Bank 1, 250 ft se and 150 ft ne of e cor Brown 100-ac tr, Stephen Hays sur	*	932
NUECES COUNTY—		
Mills Bennett, Wm. Kassner 4, sur 409 (Saxet)	*	4104
Houston Oil Co. of Tex., Rand Morgan 19, Kinney lots (Saxet)	650	4426
Rand Morgan 20, Villareal sur (Saxet)	675	4427
H. H. Howell, Rand Morgan 1, sur 415 (Saxet), perf 5746-56	¶5 & 50	7004
Humble and Barnsdall, Kate Ritter 1-A, blk 55 (Flour Bluff)	850	6658
Richardson Pet. Co., Cain & Sechrist 8, Russell Farm lots (Saxet)	450	4425
Cain & Sechrist 10, Russell Farm lots (Saxet)	475	4459
REFUGIO COUNTY—		
Cosmo Pet. Co., V. F. W. Heard 15, Refugio Town Tracts (Refugio)	475	4920
Hewitt & Dougherty, M. F. Lambert 42, Swisher sur (Tomoconnor)	1750	5900
Quintana Pet. Corp., A. Riley 3, Ximines sur (Tomoconnor)	1050	5975
United Prod. Co., F. M. Lambert 43, Swisher sur (Tomoconnor)	1050	5905
SAN PATRICIO COUNTY—		
Conroe Dr. Co., G. W. Pullin 8, W. Burns sur (Taft)	524	4366
Humble, J. W. Mayo 17, Ottman sur (Taft)	450	4923
Stanolind, Corpus Christi Bank 1, Taft Farm Lands (Plymouth-Taft)	*	5922
VICTORIA COUNTY—		
Magnolia Pet. Co., Charlie Sklar 5, SA&MG sur (Placedo)	220	4771

*Failures; †Junked; ¶Million cu. ft. gas.

GULF COAST

Distillate and brackish water in Palacios test

* * *

Shell completes second well on state prison farm

* * *

Unwatched Bammel discovery comes as surprise

Houston. — Glenn H. McCarthy's Foley Land Company 1, Palacios prospect, L. Goodwin Survey, Matagorda County, perforated casing with 20 shots from 7828 to 7840 feet and 20 shots from 7875 to 7895 feet and was reported April 1 making wash water, gas, and distillate through a 12/64-inch choke with a tubing pressure of 2600 pounds and a casing pressure of 2000 pounds. When the casing was first perforated the hole was washed for 1½ hours and then swabbed for eight hours before it kicked off. When it first came in it was making what was described as "brackish" water, but is supposed to have cleared up.

April 2 the well was reported making 6 barrels of fluid per hour through 12/64-inch choke and showing tubing and casing pressures of 2950 pounds. Twenty-five percent of the fluid was 56 gravity distillate and the remaining 75 percent was brackish water. As stated above, the well came in making brackish water and then cleared up, but after flowing for some time the well again started flowing brackish water.

Foley Land Company 1 has been one of the most closely watched wildcats in the Texas Gulf Coast for the past several months. There is no open acreage in the area, and about four or five operators control the play, but curiosity was aroused because Foley Land Company 1 was drilled a "mystery" test and no information was given out by the operators. However, during the time the test was drilled several conflicting reports were circulated concerning it.

According to the McCarthy organization, Foley Land Company 1 came in making gas and distillate at the rate of six barrels per hour in addition to wash water. The well, according to operators, did not make any salt water.

On a previous test March 26 and after washing for one hour and five minutes Foley Land Company started flowing dry gas through a quarter-inch choke and in nine hours the tubing pressure was 2690 pounds and the casing pressure was 1575 pounds. The test was made of formation between 8573 and 8583 feet. Choke on the wildcat was changed March 27 to a 3/16-inch size and later the well started making a small amount of water with distillate which tested 47.9 gravity. Shortly after noon March 27 the pressures began dropping, and at 1:30 p.m. the test started making "brackish" water, continuing to flow a large volume gas with wash water. Pressures dropped to 2200 pounds on the tubing and 1200 pounds on the casing. At noon March 28 the well was flowing approximately three barrels of fluid per hour through a ⅛-inch choke and was estimated making from 50 to 90 percent "brackish" or salt water. It was also estimated to be making 4,000,000 cubic feet of gas daily.

Foley Land Company 1 was killed and a cement retainer set after pulling the tubing and leaving the screen and liner in the hole. The hole was plugged back and casing perforated at 7828 to 7840 feet and 7875 to 7895 feet.

Palacios prospect has a long history. George Strake first went into the area and leased up a large block. Hoard Exploration Company shot the area with reflection seismograph for George Strake. After a high was found then Strake interested Sun Oil Company in the area. Sun Oil Company made a deal with Glenn H. McCarthy to drill the well, giving him around $15,000 dry hole money and other considerations. Due to the fact that McCarthy's rigs were busy in other portions of the Gulf Coast a deal was made with an East Texas contractor to whom the drilling contract was sublet. Probably the reason few companies were interested in the area was heaving shale. Mike Halbouty, geologist for the Glenn H. McCarthy Company, stated that the well encountered heaving shale, while others who are interested in the well state that it did not.

Miscalculated on Depth

Miscalculation of depth of Texas Gulf Producing Company's Gillespie 1, Aldine prospect S. Contreras Survey, Harris County, has caused the operators considerable trouble in making a production test on this potential discovery well. Seven-inch casing, which was set at what was believed to be 7180 feet, was perforated at 7097 to 7100 feet. After washing Gillespie 1 for several hours it failed to flow. But after pulling tubing, oil started showing on the ditch, causing uncertainty as to the exact location of the perforations.

Gillespie 1 was drilled to 8084 feet in shale. A gas and distillate sand cored in Upper Saline Bayou formation from 7074 to 7104 feet showed seven thribbles and one double of drilling mud, cut with distillate, and a 240-pound pressure.

Approximately 4000 feet south of the discovery well at Clinton, Harris County, Stanolind Oil & Gas Company's Oates 1, C. Martinez Survey, was drilling in sandy shale at 8557 feet. From 8491 to 8496 feet the crew cored a sand and the well attempted to blow out. Heavy mud was pumped in the hole and brought the well back under control. It is believed that Oates 1 was in oil sand at 8496 feet. Top of the Cockfield was logged at 8101 feet.

Preparing to Test at Hockley

Stanolind Oil & Gas Company's Warren Minerals 1, Hockley dome, H. & T. B. Survey No. 1, Harris County, was preparing to make a drill stem test of sands at 3665 to 3695 feet, where casing was perforated with 20 shots. During the week several drill stem tests were made. From 6456 to 6685 feet the well showed no pressure, 14 stands and one double of drilling mud in 10 minutes through quarter-inch chokes. After the test five-inch liner was set at 6433 feet and the well flowed salt water. The hole was plugged back to 3800 feet and a cement retainer set. Casing was perforated with 10 holes from 3774 to 3788 feet and a drill stem test showed 1000 feet of sulphur water with a salty taste through quarter-inch chokes on top and bottom of the testing tool. The test was made in 10 minutes and showed no pressure or oil.

Lochridge Extended East

Approximately 1700 feet east of production at Lochridge, Brazoria County, Shell Petroleum Corporation completed the second producer on the Ramsey State Prison Farms lease, adding several hundred more producing acres to the field. Ramsey State Prison Farms 2 came in flowing 370 barrels of 27.4 gravity pipe line oil in 14 hours through a quarter-inch choke from 6350 feet. Tubing pressure was 1575 pounds; casing, 1675 pounds. On a potential test the well made 577 barrels in 24 hours through a quarter-inch choke, with a tubing pressure of 1725 pounds and a casing pressure of 2000 pounds.

Gulf Oil Corporation was washing Baker 1, 750 feet south of Wilkes & Smith 2, Lockridge field, J. W. Hall Survey, for a production test at 6368 feet. Five and half-inch casing was cemented at 6368 feet after a production test at 6358 feet showed only five barrels of oil per hour.

Hastings field, Brazoria County, was extended 660 feet northwest last week when Coastwide Petroleum Company completed C. A. Brown 2, B. B. B. & C. Survey, for a commercial producer at 6080 feet. Brown 2 made 650 barrels of pipe line oil daily through a quarter-inch choke and showed tubing and casing pressures of 900 pounds. Stanolind Oil & Gas Company completed four wells at Hastings last week. Each of them made more than 600 barrels daily through a quarter-inch choke.

On the southeast flank of Boling dome, Ft. Bend County, Mack Hank Oil Company completed another Frio producer in Farmer 4-C, Jas. Scott Survey. The well came in from sands at 4817 to 4859 feet

flowing 525 barrels of pipe line oil daily through a quarter-inch choke with a tubing pressure of 550 pounds and a casing pressure of 640 pounds.

Pickett Ridge Extended Northwest

Pickett Ridge field, Wharton County, was extended northwest last week when The Texas Company completed Joe Tlustos 1, H. & T. C. Survey, Abstract 129, flowing 37 barrels of oil daily through a 6/64-inch choke, with a tubing pressure of 1100 pounds and a casing pressure of 1600 pounds from 4602 feet.

Approximately five miles east of Louise field, Wharton County, The Texas Company abandoned E. A. Weatherer 1, E. T. R. R. Survey, Section 100, at 6524 feet in Frio formation after coring sand and shale with an odor of oil from 5204 to 5286 feet. A drill stem test of the 5200-foot sand showed salt water. It is rumored that The TexasCompany will drill another well in this area.

Salt Water in Jefferson County Test

Humble Oil & Refining Company's Jefferson Land Company 1, Cheek area, C. Hillibrand Survey, showed salt water for the second time last week when 7-inch casing was perforated with 15 shots from 7830 to 7845 feet in Frio formation. After perforating, the swab was run three times and the wildcat kicked off and cleaned itself, showing a tubing pressure of 2700 pounds and a casing pressure of 300 pounds. The crew bled the tubing down to zero and the well showed salt water. After letting the well flow again it showed gas and salt water through ¼-inch choke. Then tubing pressure was 2375 pounds and casing pressure 800 pounds. At the end of the week the crew was cutting and pulling screen and liner.

Salt Dome Oil Corporation's Lawrence 1-C, S. Barrow Survey, South Cotton Lake, Chambers County, made 25 barrels of 32 gravity pipe line oil per hour through ¼-inch choke on a potential test last week. Tubing pressure was 1100 pounds and casing pressure was 800 pounds. The well was completed in Frio sands at 6503 feet. The corporation has made location for 5 wells in the field. Derrick is being skidded from Lawrence C-1 to Lawrence D-1, 466 feet from the east line and midway between the north and south lines of a 24.5-acre tract in the S. Barrow Survey.

Stanolind Oil & Gas Company announced another location for a well at Turtle Bay, Chambers County. F. C. Silva 1 is 394 feet from the north line and 1273 feet from the east line of a 57.47-acre tract in the S. Burney Survey.

Approximately 2½ miles east of Onalaska, Polk County, C. E. Gates announced location for L. O. Jackson 1, 330 feet out of the north corner of a 50-acre tract in the E. Clark Survey.

Bammel Wildcat Flows Gas and Distillate

A new gas and distillate producing district was discovered last week when Hamil & Smith's Zapp 1, Bammel prospect, J. Farwell Survey, Harris County, came in making 3 barrels of 58.3 gravity distillate daily, along with a large volume of gas, after casing had been perforated with 12 shots from 6205 to 6211 feet in Cockfield formation. Prior to the production test, Zappe 1 had been perforated from 6412 to 6428 feet with 36 shots, and 2½-inch tubing was hung at 6337 feet. Swabbing for 2½ hours, the test showed salt water and was then plugged back.

Zappe 1 was taken over from George Lawrence et al by Hamil & Smith after the former had drilled the wildcat 6525 feet. The latter drilled down to 6623 feet, where 5½-inch casing was cemented.

There have been five other Cockfield tests drilled in the Bammel area and each showed evidence of gas, oil and distillate, but after testing salt water in Cockfield formation each was abandoned. Completion of the well came as a surprise. When the well started flowing gas and distillate through ⅛-inch choke and showing tubing pressure of 900 pounds and 1100 pounds on the casing, it was thought it would turn to salt water. When shut in, pressures of 1850 pounds on the tubing and 2100 pounds on the casing were recorded. Bottom hole chokes were installed, ¼-inch on top and 9/64-inch on bottom, and the wildcat increased the flow of distillate.

On the northwest side of Dickinson, Pure Oil Company completed Schelor 1-B, G. W. Banks Survey, flowing around 240 barrels of 39.3 gravity oil daily through ¼-inch choke with tubing pressure of 1320 pounds, casing pressure 1050 pounds, from Frio sands at 8044 to 8050 feet. The well was drilled to 8108 feet in shale and 5½-inch casing was set at 8108 feet. Casing was perforated with 12 holes from 8068 to 8075 feet, and an 11-minute drill stem test showed a 500-pound pressure and 6 thribbles of mud and oil, 30 percent oil. Schelor 1-B topped the Discorbis at 6755 feet, Heterostegina 7000 feet, round Marginulina 7165 feet, and the flat Marginulina at 7280 feet. A gas show was encountered at 7954 feet.

Dickinson Outpost Is Gasser

Pure Oil Company's C. Hutchins, north extension to Dickinson, was making gas and washwater at the close of the week from Frio sands at 8061 feet. The well was on a ¼-inch choke. Tubing pressure was 2400 pounds and casing pressure 2700 pounds. Five-inch casing, cemented at 8111 feet, was perforated with 12 shots from 5058 to 5061 feet. After running screen and liner, the well came in flowing gas. Top of the Discorbis was logged at 6975 feet, Heterostegina at 7260 feet, and Marginulina faulted out.

In the same area as the above two wells, Atlantic Refining Company was preparing to make a production test at 8098 feet on G. O. Anderson 1, P. G. Merritt Survey. An electrical logging device showed sands from 8066 to 8092 feet. G. O. Anderson 1 was spudded in March 10 and drilled to the producing sand in less than 20 days. It topped Discorbis at 6483 feet, Heterostegina at 7020 feet, round Marginulina at 7245 feet, and flat Marginulina at 7336 feet. Atlantic Refining Company has made location for P. C. Roberts 1, 330 feet out of the northwest corner of the P. C. Roberts 57-acre tract in the P. G. Merritt Survey. It is an east offset to Pure Oil Company's Hutchins 1.

One of the best wells yet completed at Dickinson was Humble Oil & Refining Company's Maco Stewart A-16, W. K. Wilson Survey, which came in flowing 38 barrels of oil per hour through ¼-inch choke from 8850 feet. Seven-inch casing was set at 8817 feet and 2½-inch tubing hung at 8719 feet.

TEXAS GULF COAST Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
AMELIA—		
Humble, Industrial Dev. Co. 1	151	6780
ANAHUAC—		
Humble, Tyrell 14	*	lcn.
Sun, White 24	168	7128
BARBERS HILL—		
D. B. McDaniel, Wilbrun 4	365	5271
BIG CREEK—		
R. Y. Walker, Bryan et al 3	75	3632
BOLING—		
Mack Hank Oil Co., Farmer 4-C	525	4859
CONROE—		
Houston Oil Co., Hooper 1 (wo)	360	5099
Humble, Taylor 1	*	5239
DICKINSON—		
Humble, Bayou Dev. Co. C-1	576	8038
Maco Stewart A-16	912	8850
Pure Oil Co., Shelor 1-B	252	8108
GOOSE CREEK—		
Humble, Simms 28	*	lcn.
HASTINGS—		
Coastwise Pet. Co., Brown 2	650	6080
Stanolind, Blount 2	636	6080
Long 2	600	6080
Surface 3	612	6080
Williams 8	624	6080
HIGH ISLAND—		
Stanolind, Smith B-14 (wo)	292	5084
HULL—		
Gulf, Phoenix 71 (wo)	43	3470
HUMBLE—		
Hurley Prod. Co., King 2	12	1001
LOCHRIDGE—		
Shell, Ramsey State Prison Farms 2.	577	6371
NOME—		
Sun, Long 1 (wo)	¶½	6050
ORCHARD—		
Gulf, Moore 51	*	2662
PICKETT RIDGE—		
Texas Co., Tlustos 1	37	4602
RACCOON BEND—		
Humble, Diemar 7-X	*	4202
Sherrod C-15	1128	3155
SARATOGA—		
Rio Bravo, Fee B-500	60	1782
SEABREEZE—		
Sun, White 1-A (wo) (dr to 8600 ft, pb 8346 ft)	6	8600
SOUTH COTTON LAKE—		
Salt Dome, Lawrence 1-C	600	6503
TOMBALL—		
Humble, Murphy 1	456	5561
Tomball Townsite Unit 14, No. 1.	492	5584
WHARTON COUNTY—		
Texas Co., Weatherer 1, e of Louise Ogden sur	*	6524

*Failures; †Junked; ¶Million cu. ft. gas.

320 TEXAS PERMITS

Austin.—The Texas Railroad Commission approved last week permits for drilling 320 new wells in Texas, 12 more than allowed the week before.

North Texas operators reported 74 locations, which included 25 in Jack County and 20 in Wichita County. There were 22 locations from West Central Texas.

West Texas reported 71 permits, with 14 in Winkler County, 12 in Ector County, 11 in Ward County, and 11 in Upton County. There were 13 permits from the Panhandle.

Southwest Texas reported 73 locations, with 20 permits for wells in Duval County, 16 in Zapata County, and 10 in Webb County. There were 44 locations from the Gulf Coast, with 17 in Nueces County.

East Texas reported 12 locations, including 6 in Gregg County, 3 in Smith County, 3 in Upshur County, and 1 in Cherokee County. There were 11 locations for wells in other fields of East Central Texas.

Salt Dome Found

BY TEXACO AT 8848 FEET ON HENDERSON TEST

Lake Charles.—The Texas Company discovered a salt dome in the Louisiana Gulf Coast March 31 when St. Martin Land Company 9, Henderson prospect, Section 21-8s-7e, St. Martin Parish, topped salt at 8848 feet and cored in that formation to 8858 feet.

Henderson prospect was discovered by reflection seismograph by The Texas Company in 1934. The operator's St. Martin Land 6, Section 17-8s-7e, had oil shows from 8850 to 8860 feet and was abandoned at 9771 feet. St. Martin Land 7, Section 17-8s-7e, encountered a slight showing of oil from 4400 to 4404 feet and was abandoned at 8986 feet, and State Plumb Bob 1 quit in salt water sand at 8205 feet. The company's St. Martin Land 8 had showings of oil from 4753 to 4760 feet, 5972 to 5975 feet, 6150 to 6161 feet, 6195 to 6199 feet, and sandy shale showing oil from 6298 to 6302 feet. The hole was carried down to 8871 feet and abandoned in July, 1936.

St. Martin Land Company 9 was spudded December 15, 1936, and 20-inch casing cemented at 101 feet. Another string of casing was cemented at 1269 feet. At 8545 to 8551 feet sand was encountered which showed dead oil.

Test at South Roanoke

Shell Petroleum Corporation's Sturdevant 1, South Roanoke prospect, Section 25-10s-4w, Jefferson Davis Parish, perforated casing with 56 holes from 8570 to 8590 feet March 31 and made a drill stem test which showed salt water. With the packer at 8550 feet, the test showed 255 pounds pressure in eight minutes. After breaking down the drill stem the operators recovered 34 stands of salt water, two joints of sand and no showing of oil. At the end of the week the crew was setting a cement retainer and probably will make another test.

Sturdevant 1 was drilled to 9749 feet, where the drill stem stuck. After fishing several months the hole was plugged back and seven-inch casing cemented at 8630 feet. Considerable trouble was experienced with gas 9400 feet.

On the old Section 28 prospect, which is a salt dome, Joe E. Lilly et al made location for Robert Martin 1, NW SE NE 32-10s-7e, St. Martin Parish. About 12 tests drilled in this area have been dry. The deepest well went to 6761 feet. Cap rock is usually encountered around 1030 feet and salt logged at 1250 feet.

Deep Test Fishing

The Texas Company's Horseshoe Bayou 1, Wax Lake prospect, Section 40-17s-9e, St. Mary Parish, was reported to have encountered 30 feet of oil sand at 10,975 feet which showed 30 ohms on an electrical logging device. After running a survey, around 9500 feet of the equipment was lost in the hole and at the close of the week the crew was fishing.

At 10,975 feet a string of 7⅝-inch casing was cemented, the longest string of this size casing ever set in the Louisiana Gulf Coast. If there are 30 feet of oil sand at 10,975 feet that will produce, Wax Lake will be the deepest producing field in the world.

Another interesting wildcat which The Texas Company is drilling in St. Mary Parish is being watched very closely. State Bateman Bay 1, Section 21-16s-12e, Morgan City prospect, was drilling in shale below 7464 feet at the close of the week and is making record time in drilling.

Hurrying on Bateman Island

The Texas Company leased around 5000-acres around Bateman Island and worked the area with reflection seismograph and torsion balance in 1935. It is understood that a large closure was found and many operators class this area as a class "A" prospect. Evidently The Texas Company knows approximately where to pick up the sand because of the fast drilling. No coring has been done on the well down to 7464 feet.

Herton Oil Company completed another producer at Jeanerette, St. Mary Parish, last week. Carter 5, Section 38-13s-9e, made 450 barrels of 36.6 gravity pipe line oil daily through a 7/32-inch choke with a tubing pressure of 950 pounds from sands at 7016 to 7054 feet. Seven-inch casing was cemented at 7037 feet. The company's Barrilleaux 2, Section 59-13s-8e, was being completed at the close of the week at 6670 feet. Sand showing oil was logged at 6665 feet and seven-inch casing cemented at 6650 feet.

East of Jeanerette, Pan American Production Company cored a sand showing oil from 5940 to 5944 feet in

SOUTH LOUISIANA Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
CAILLOU ISLAND—		
Texas Co., State Caillou Island 46	1156	4913
DOG LAKE—		
Texas Co., L. L. E. Dog Lake 4	1516	6894
FOUR ISLE—		
Texas Co., State Four Isle 8	*	9526
JEANERETTE—		
Herton Oil Co., Carter 5	450	7054
LAFITTE—		
Texas Co., Rigolets 6	1392	9476
LEEVILLE—		
Texas Co., L. L. E. Leeville 62	482	4015
NEW IBERIA—		
Texas Co., Duhe et al 1	1200	4794
SORRENTO—		
Pan American, United Lands 8	*	6043
CALCASIEU PARISH—		
Amerada-Stanolind, Calcasieu National Bank 1-B, China prospect, 28-7s-3w	*	9139
ST. MARTIN PARISH—		
Stanolind, Numa Patin 1, Anse La Butte area, 46-9s-5e	*	6147

*Failures; †Junked; ¶Million cu. ft. gas.

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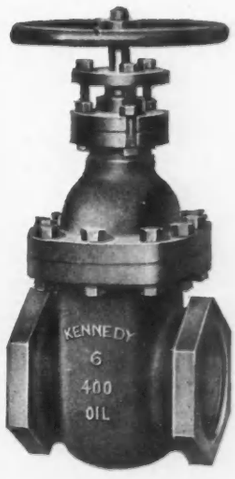
that close tightly, open easily, and stand hard service



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KENNEDY

VALVES-PIPE FITTINGS-FIRE HYDRANTS

Lawes 2, Charenton, Section 25-13s-9e, St. Mary Parish. At the end of the week the crew was drilling ahead below 6209 feet in shale and will carry the well down to the regular producing sand around 7000 feet.

Valentine Well Attempts Blowout

Pan American Production Company's Harange 3, Section 8-17s-20e, Valentine field, Lafourche Parish, attempted to blow out at 7491 feet when the operators were coming out of the hole with a core from 7481 to 7491 feet. April 1 the company was conditioning mud to bring the core out. Harange 3 is about 140 feet lower than other wells in the area and only cored one-foot of sand from 7089 to 7091 feet. Pan American Production Company made location for Harange 5, 660 feet north, 45 degrees west of Pan American Production Company's Harange 2, Section 8-17s-20e, Lafourche Parish.

On Marchland prospect, Lafourche Parish, William Helis' City of New Orleans 1, Section 19-23s-23e, cored a sand from 7303 to 7333 feet which contained a good odor and cut of oil and was running an electrical logging device at the end of the week. City of New Orleans 1 was the discovery well of a new salt dome in Louisiana Gulf Coast. The well logged the top of the salt at 7463 feet and drilled to 8012 feet in that formation.

Third Dog Lake Well

The third oil well completed by The Texas Company at Dog Lake field, Terrebonne Parish, out of 17 attempts was put on production last week when L.L.E. Dog Lake 4, Section 5-22s-16e, made 1516 barrels of 40 gravity oil daily through a ⅜-inch choke with a tubing pressure of 1320 pounds from sands showing oil from 6870 to 6877 feet. The hole was drilled to 6894 feet and seven-inch casing was cemented at 6871 feet.

The Texas Company had a busy week in the Louisiana Gulf Coast last week completing big oil wells. Besides L.L.E. Dog Lake 4, the company completed L.L.E. Leeville 62, Leeville, Lafourche Parish, making 482 barrels of 29.4 gravity oil from 3934 feet; Duhe et al 1, New Iberia, Iberia Parish, flowing 1200 barrels of 25.2 gravity oil from 4794 feet. The company also extended the Lafitte field east by completion of Rigolets 6, Section 29-17s-24e, Jefferson Parish. The extension well made 1392 barrels of 37.4 gravity oil from 9476 feet. At Caillou Island the company finished State 46 for 1156 barrels of 38.7 gravity oil from 4910 feet. Out of six completions in the area during the past week five were oil producers, and one was a failure. The only failure completed by the company was at Four Isle field, Section 14-21s-16e, Terrebonne Parish, but the well established a new deep drilling record for the field. State Four Isle 8 was drilled to 9526 feet in salt after logging the top of the formation at 9519 feet.

In Plaquemines Parish, Gulf Oil Corporation made a production test on Lafourche Basin Levee District 6, Lake Hermitage, Section 12-8s-25e, in a new sand at 6390 feet, which showed salt water. At the end of the week the test was drilling ahead around 6400 feet. Sand showing oil was encountered in the test from 6370 to 6390 feet and seven-inch casing cemented at 6373 feet.

Another 11,000-Foot Test

The third 11,000-foot well for the Louisiana Gulf Coast was recorded last week when Humble Oil & Refining Company's Ellender 1, Houma gas field, Section 23-19s-19e, Terrebonne Parish, penetrated formations below 11,284 feet. Ellender 1 is reported to have cored a broken formation from 10,794 to 10,846 feet which contained an odor of oil.

A new deep drilling record has been set by Humble Oil & Refining Company in Darrow field, Ascension Parish. At the end of the week the company was drilling below 8000 feet in shale on Gumble 9, Section 35-10s-2e.

Pan American Production Company abandoned United Lands 8, Sorrento dome, Section 15-10s-4e, Ascension Parish, at 6043 feet in salt after logging the top of the formation at 6037 feet.

At Jefferson Island dome, Iberia Parish, Jefferson Lake Oil Company's Lake Peigneur 414, 12s-5e, was being rocked with gas at 6939 feet at the end of the week. The company is attempting to make the well flow after swabbing failed.

China Wildcat Abandoned

On China prospect, Section 28-7s-3w, Jefferson Davis Parish, Amerada Petroleum Corporation and Stanolind Oil & Gas Company abandoned Calcasieu National Bank 1-B at 9139 feet after the well blew out and the drill stem stuck. It is understood the well was in Vicksburg formation when it blew out. Going back in the hole it was found that the 10-inch casing had parted and the fishing equipment would not go below 2000 feet. The two companies are reported preparing to drill another well in the area.

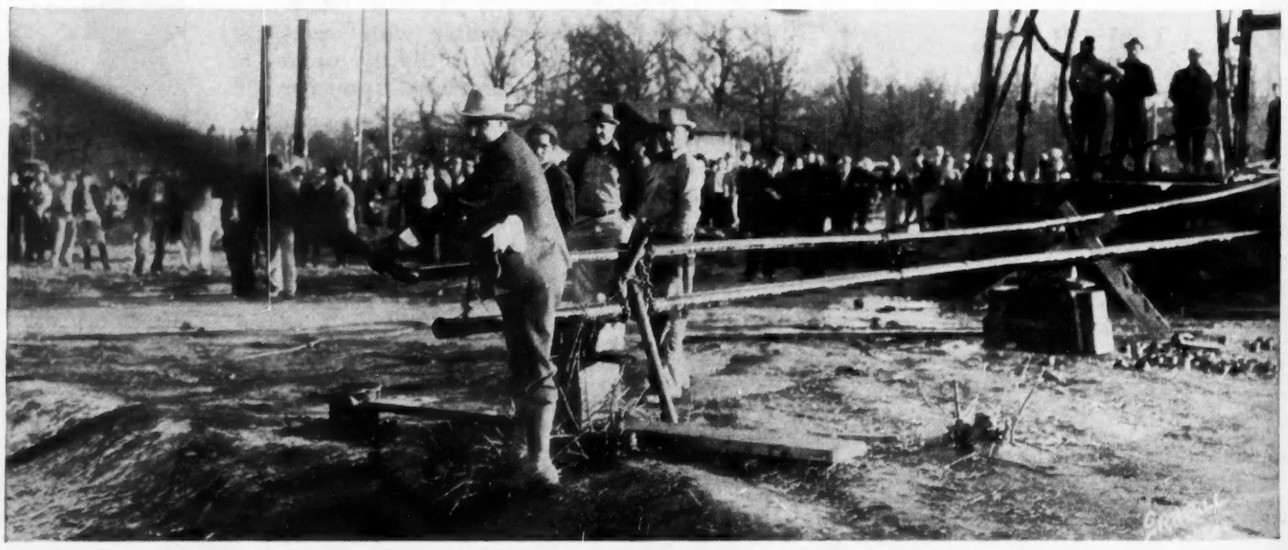
Humble Oil & Refining Company's Nordyke 1, Ebenezer prospect, Section 23-10s-1e, Acadia Parish, was drilling below 9706 feet at the close of the week after encountering a sand around 9435 feet which is supposed to have shown 30 ohms on an electrical logging device.

On the west side of Jennings, Acadia Parish, A. C. Glassell's Trushel 1, Section 42-9s-2w, cored oil sand from 6930 to 7010 feet and was reported setting casing for a production test at the end of the week.

Union Sulphur Company's Hebert 1, Big Lake area, Cameron Parish, cored a sandy shale showing oil from 6988 to 7004 feet and was running an electrical logging device at the end of the week. The company may make a production test of this sand.

SAXET HEARING

Austin.—A hearing on the deep Saxet field in Nueces County has been scheduled by the Texas Railroad Commission at Austin for April 15 when the commission will take evidence upon which to base rules covering operations of wells producing from 6000 feet or deeper. Operators have indicated a desire for 20-acre spacing for the deep wells, although the rule now in effect allows one well to 10 acres.



Scene at completion of the discovery well of the Lisbon field, Claiborne Parish, Louisiana

NORTH LOUISIANA

Lisbon is most important discovery since Rodessa

* * *

Sugar Creek gas area now showing for oil

* * *

Marion County Rodessa extension test makes gas

Shreveport.—Apparently on the way to become North Louisiana's first oil field of any magnitude since discovery of Rodessa oil in July, 1935, Lisbon, Claiborne Parish, discovered last December with completion of E. T. Oakes, H. D. Easton and associates' Patton Estate 2, NE NE 1-20n-5w, last week was extended one-half mile and three-fourths mile north and northwest, respectively, by two good oil producers. The field now has four oil producers from basal Glen Rose lime at the 5300-foot level.

Several Offsets Required

With several offset operations required by completion of the last two wells and a number of locations tentatively made, nine definite locations were announced last week, three of which were by Gulf Oil Corporation—two of them have already spudded and cemented surface casing. Gulf's two new operations are H. E. Patton 1 and 2, NE SW 36-21n-5w, and Maggie Patton 1, SW SW 31-21n-4w, the latter being an east offset to Oden and Evans' Patton 1, SE SE 36-21n-5w, which has been averaging 475 barrels daily for over 10 days following its completion as the second producer of the field.

Mile Northwest Extension

The third producer for the field is Lyons and Neely's H. E. Patton 1, NW SW 36-21n-5w, completed at 5292 feet flowing 33 barrels per hour through one-inch tubing choke to extend the field three-fourths of a mile northwest. These operators are moving in rig for Maggie Patton 1, NW SW 31-21n-4w. These operators have seven 40-acre tracts in this area.

Love Petroleum Company made locations for H. E. Patton 1 and 2, SW SE 36-21n-5w; T. L. James Company for H. W. Patton 1 and 2, NE SE 36-21n-5w, and McMillan and DeArmand for Maggie Patton 1, NE SW 31-21n-4w. Standard Oil Company of Louisiana and Magnolia Petroleum Company will have to drill offsets to the last two producers added in the field.

Half-Mile North Extension

The fourth producer for the field which extended production one-half mile north was Red Iron Drilling Company's H. E. Patton 1, SW NE 36-21n-5w, completed without swabbing at the plugged back depth of 5312 feet flowing an estimated 40 to 50 barrels per hour. It was not thoroughly cleaned Thursday.

Two miles west of the Oakes-Easton discovery well, Lisbon Oil Company's J. W. Burgess 1, SE NE 3-20n-5w, which logged only one and one-half feet of saturation in the Oakes horizon, was drilled into the Travis Peak at 5406 feet. This test showed stains of oil in a core from 5444 to 5463 feet. Later an electrical tester was run. No test has been made of the lower horizon.

Leasing and trading has taken on added impetus as a result of the recent extensions. Several representatives of companies which do not have close-in acreage have been submitting prices to higher authority for endorsement before buying. The majority of the close-in acreage is held by independents.

Oakes and Easton's Patton Estate 2, NE NE 1-20n-5w, the discovery well of the field, was completed at 5378 feet, after Patton Estate 1, only 50 feet away, had been lost as a junked hole at 4241 feet.

History of Discovery Interesting

An interesting history is connected with the drilling of the discovery well. The Patton family, friends of H. D. Easton, who had worked out the geology of this area in 1920, provided in the leases when they were drawn that Easton should have supervision of the drilling of the test on their property. Oakes, a former major league baseball player, had been associated with Easton previously in 1931 to 1934 in the drilling of a wildcat test in DeSoto Parish, and it was to Oakes that Easton insisted that the acreage be assigned, Easton being also an associate in the project.

Oakes is a native of Claiborne Parish, and by standing on top of the 122-foot derrick on this well can see his birthplace and the family cemetery in which many of his relatives rest.

Financing the wildcat was not easy, for in reality he had to drill over 9,000 feet in the two holes before his well was completed. Residents of Claiborne Parish took interests in the test and it was drilled to a large extent by local capital, although a number of residents of Little Rock, Arkansas, took an interest.

Sugar Creek Oil

Shreveport.—Probability that the southwest flank of the Sugar Creek gas-distillate field, Claiborne Parish, will produce oil appeared assured last week when United Gas Public Service Company's, Sugar Creek Syndicate's and Standard Oil Company of Louisiana's SE NE 1-19n-5w flowed 136 bar-

Left to right: E. T. (Rebel) Oakes, G. L. Morelock and H. D. Easton, three of the owners of the discovery well in the Lisbon oil field.

rels of 32 gravity oil in 2½ hours after acid was used. Total depth is 5984 feet and 5⅜-inch casing was cemented at 5719 feet.

After the well showed for an oil producer, it was shut in awaiting erection of storage. This is a unitized field, all acreage being owned jointly by these three companies. The northeast flank of the field was opened several months ago as a gas-distillate producing area in the Travis Peak after having yielded wet gassers for several years from the Glen Rose.

O. G. Collins continues to lease extensively in Caddo Parish, in Township 21 north, Ranges 14 and 15 west. He is said to be representing a company which, it was announced several months ago, planned a 7000-foot test in the old Pine Island field.

Saltmount Oil Company of San Antonio, Texas, has been taking scattered leases in Township 14 north, Range 7 west, and H. L. Hunt is leasing in the same parish in Township 17 north, range 6 west.

In Webster Parish, Drew & Turner of Minden are assembling a block in Township 19 north, Range 9 west.

Marion Well Makes Gas

Shreveport.—Dunn & Fisher's Susie A. Chatten 1, A. de los Santos Coy Survey, Marion County, Texas, along the Rodessa Fault, was completed last week at 5955 feet in top of Gloyd formation, making an estimated 50,000,000 cubic feet of gas daily with a spray of distillate. It is 7½ miles southwest of Rodessa production in the field proper.

The well had not thoroughly cleaned itself Thursday as operators prepared to move in tankage for the distillate. Casing was cemented at 5794 feet to take in saturation which had appeared in both basal Hill and Gloyd horizons. Elevation is 247 feet. Top of the Hill was 5800 feet and top of the Gloyd 5914 feet. Massive anhydrite was logged from 5417 to 5672 feet. It checked 17 feet higher on top of the massive anhydrite than did Arkansas-Louisiana Gas Company's W. S. Ford 1, Charles Grayson Survey, which is 2½ miles northeast of it toward Rodessa's producing limits.

Arkansas-Louisiana Gas Company's W. S. Ford 1, 5 miles southwest of production, after casing was perforated was loaded with 425 barrels of oil and the well flowed 375 barrels of oil in 12 hours and then averaged 8 barrels per hour flowing with casing pressure 250 pounds and tubing pressure 25 pounds.

The same company's Laura McIntosh 1, William Edmonson Survey, Marion County, has cleaned hole and drilled to 6010 feet and set 7-inch casing at 5952 feet after reported oil saturation was logged in the Gloyd. This test logged first anhydrite stringer at 5176 feet and logged massive anhydrite from 5444 to 5706 feet, with top of the Hill logged at 5836 feet; elevation is 272 feet. This test is 2½ miles southwest of Rodessa production.

Installing New Packer

The 14-mile southwest outpost test of Holcombe, Thomasson and associates, Lizzie Henderson 1, R. Bennington Survey, is having new packer installed after another packer set between the gas and oil formations gave way. Before it gave way the well was averaging 6 to 8 barrels of oil per hour.

Fohs Oil Company is moving in materials for C. F. Whitfield 1, northwest corner of the R. Bennington Survey, northwest of Holcombe, Thomasson and associates' Lizzie Henderson 1 in the same survey. Shell Petroleum Corporation has staked locations for Lizzie Henderson 1 and 2 in the same survey. Over a mile northwest of its W. S. Ford 1, Charles Grayson Survey, Arkansas-Louisiana Gas Company has made location for E. E. Hicks 1, L. P. Cadenhead Survey, Marion County. In the Cass County part of Rodessa, Magnolia Petroleum Company, which has had considerable success recently with wells on this lease in the Gloyd horizon, made locations for Lizzie Haywood 20, 21 and 22, Priscilla Evans Survey.

Due to reported favorable showings at two depths in R. W. Norton's Payne 1, SE SE 27-23n-16w, Caddo Parish, south of the Rodessa Fault, which is coring below 8827 feet, and is reported to have casing on the ground to set when contemplated depth of 10,000 feet is reached, considerable leasing has developed south of the fault on the Louisiana side.

Marr & Perkins' Hunter 5, Section 13-23n-16w, in the heart of the Rodessa field, being deepened to Travis Peak, is drilling ahead below 6727 feet after a reported showing in 3 feet of formation at 6528 feet. United Gas Public Service Company's J. W. Land 1, R. Potter Survey, Cass County, is drilling below 6565 feet.

Going Back in Test

Shreveport.—L. S. Fite and Grogan Oil Company's J. W. Ramsey 1, Section 36-11n-11w, DeSoto Parish, wildcat, recently abandoned at 3027 feet, was being rigged up again last week so that casing might be run after an electrical tester was used to determine source of oil that began to flow around the surface casing and plug in the hole. Nothing but surface pipe had been cemented. The electrical tester was run to determine what horizon was yielding the oil, the first theory being that it was coming from the Saratoga chalk.

The well is 6 miles southwest of the old Naborton-Bull Bayou field.

Rodessa Connections

Shreveport.—Effective April 1, United Pipe Line Company connected to all of United Gas Public Service Company's leases in the Rodessa field. Previously Magnolia Pipe Line Company had been taking the production from five United leases on which were 20 wells, with a daily production of 1560 barrels.

Gulf Pipe Line Company is connecting to R. W. Norton's recently completed Harin 1, Section 20-23n-16w, and will also lay 4000 feet of 6-inch line to Norton's Davis lease in the H. Holbert Survey, Cass County. Southern Liberty Pipe Line Company has connected to all of American Liberty Oil Company's wells except one on the Rambo lease in the J. H. Rives Survey, which is a small well.

It is reported that McAlester Fuel Company is planning to buy part of the Griswold Refining Company's gathering system at Rodessa and will deliver its own production to Southern Liberty Pipe Line Company.

J. Edward Jones who recently opened an extension on the Louisiana side of the field on his Sharpe lease in Section 4-23n-16w, is planning a 6-inch gas line from his Rodessa townsite wells in Section 23-23n-16w, to Section 4-23n-16w, where he may erect a small gasoline plant and use the residue gas for drilling fuel.

Cotton Valley Rules

Shreveport.—Uniformity of operation of wells in the Cotton Valley field, Webster Parish, which in recent months has uncovered gas-distillate and oil production in both the Travis Peak and lower Marine horizons, was discussed last week at an informal meeting of engineers of companies operating in that field.

This preliminary meeting was held to discuss the field's problems in anticipation of regulations that may be issued soon by the minerals division, Louisiana Conservation Commission. No regulations, aside from restriction of drilling to 1 well to each 40 acres, and the usual regulations for setting of casing and safety precautions have been issued.

The question of classifying gas-distillate wells as either oil wells or gas wells will likely be raised at an early date in that field.

No formal action has been taken so far by operating companies to organize any such supervisory and advisory committee as has been done in the case of the Rodessa field.

Rodessa Allowable

Shreveport.—The daily field allowable for the Louisiana side of Rodessa was left at 50,000 barrels for the month of April, the same figure as for March, according to the proration order for the month promulgated by William G. Rankin, Louisiana Conservation Commissioner. The augmented field allowable was placed at 66,000 barrels for April.

Allocation was equally divided on the basis of 66,000 barrels to bottom-hole pressure and to acreage. The area allotted to oil wells was 6,327.5 acres and using an acreage factor, one acre equals 5.2153 barrels.

Bottom-hole pressures taken from a contour map of the commission as of March 1, 1937, shows total bottom-hole pressures of 477,456 pounds and as a bottom-hole pressure factor one pound equals 0.0691 barrels.

NORTH LOUISIANA

Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
SABINE PARISH (Converse)—		
W. G. Ray Drilling Co., Looney 2, 30-9n-13w	75	2080
SABINE PARISH (Zwolle)—		
Ellis Prod. Co., Small 1, 24-7n-11w	*	3802
CADDO PARISH (Rodessa)—		
United Gas, Rodessa 27, 15-23n-16w	126	5993

*Failures; †Junked; ¶Million cu. ft. gas.

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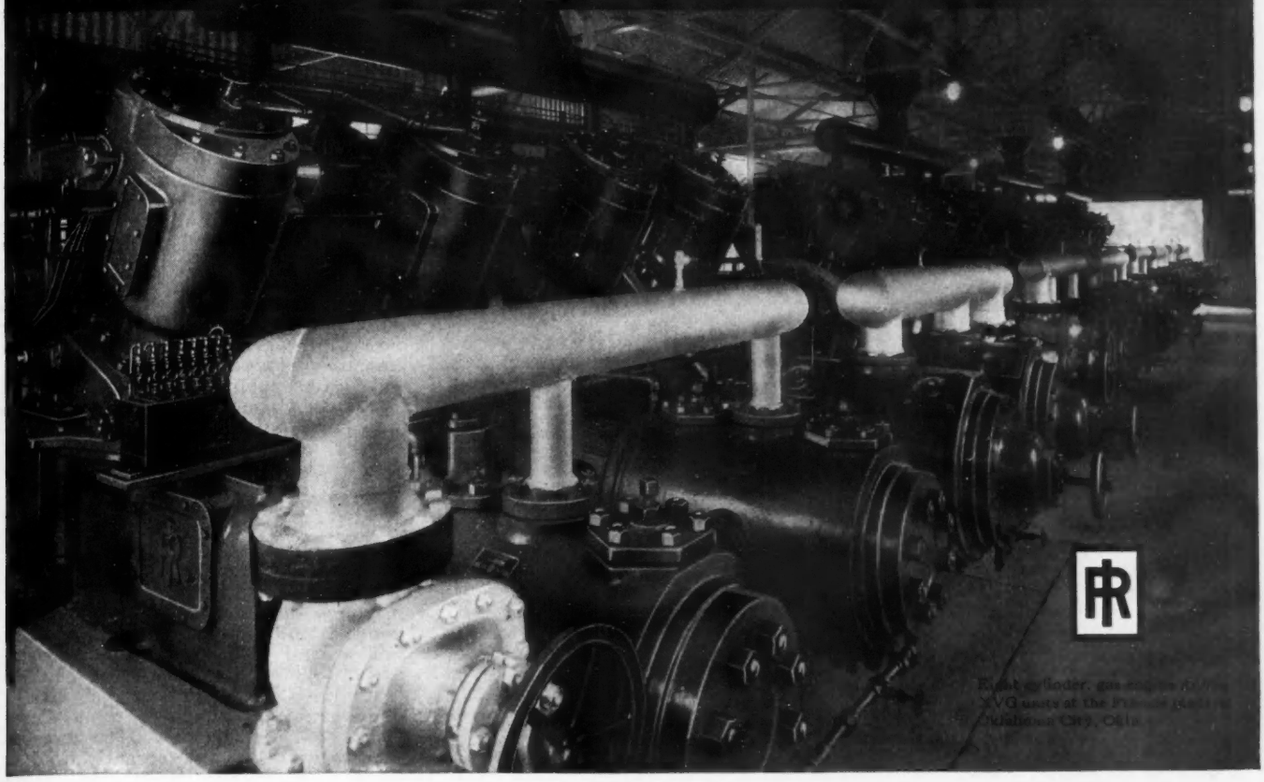

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369-1

ARKANSAS FIELDS

Wildcat show justifies work on line

* * *

Moving in for test in Ashley County

El Dorado, Ark.—Lion Oil Refining Company's Morgan 1, Section 18-18-17, Union County, near Shuler, that tested a hole full of oil in 2 drill-stem tests at 5547-5559 feet, and then developed a fishing job, successfully cleaned hole and has cemented seven-inch casing at 5555 feet and will drill plug and test early in the coming week; elevation is 219 feet.

This well logged two strata of oil-bearing sand near bottom of the hole. From 5544 to 5546 feet an oil sand was logged, the next 10 feet being green shale with silt stone and then the last three feet from 5556 to 5559 feet was an oil sand. Casing will be perforated so as to take in the upper oil stratum.

Some difference of opinion has arisen as to whether this formation is basal Travis Peak or upper Permian. At any rate so confident is Lion Oil Refining Company in the success of the well that it has begun purchase of right-of-way for a 6-inch line from its El Dorado refinery to the well, a distance of 14 miles. Used 6-inch pipe will be used.

A considerable leasing campaign has developed northwest and southeast of this test, which was drilled to 4270 feet by Phillips Petroleum Company after geophysical exploration. The latter company still owns a considerable interest in the block. The leasing has extended across the line into Louisiana. Taking part in the "play" have been Magnolia Petroleum Company, Hunt Oil Company, Blackwell Oil & Gas Company, J. K. Wadley and Buffalo Oil Company.

W. D. Wingfield of El Dorado has assembled a block of 3,000 acres centering around Section 18-16-14, Union County, for a proposed 5,000 foot test.

Joe Modisett of El Dorado and Phillips Petroleum Company are moving in materials for a proposed 5400-foot wildcat test in Ashley County, southeast Arkansas, Stillions Lumber Company 1, SW NW 18-17-9, on a geophysical prospect.

ARKANSAS

Completions

Company, Well and Location		Init. Prod. Bbls.	Depth
DALLAS COUNTY—			
Walter Lown, Tr., G. Atkinson 1, 7-10-13	*		2763
HEMPSTEAD COUNTY—			
Imperial O&G Products Co., Foster Est. 1, 35-12-26	*		3683
NEVADA COUNTY—			
C. B. & F. Pet. Co., Wm. Haynie 1, 5-14-20	*		2123
Axel Larson, Tr., J. T. Wortham Est. 1, 29-13-21	*		2340
Berry Asphalt Co., Junie Haynie 1, 6-14-20	*		1202

*Failures; †Junked; ¶Million cu. ft. gas.

An Apology . . . With Reservations

We never would have guessed it from any experience of our own, but we understand from other sources that our customers are hard to please. Now and then one moves to other fields and supply companies find him a bit critical. For which we apologize —but with no intention of changing our ways. We've been "spoiling" our customers for 25 years.

PELICAN

WELL TOOL & SUPPLY COMPANY

SHREVEPORT, LOUISIANA

PELCO

Lake Charles—Houma—Converse
New Iberia—Rodessa—Monroe—Cotton
Valley—Turnertown—Greggton—Houston

SOUTHEASTERN STATES

Mississippi leasing is accelerated

* * *

Gulf takes million acre lease in Florida

Jackson, Miss.—The leasing and geophysical exploration campaign in a prolongation of the "Conroe Trend" in south Mississippi, that was given an added impetus recently with discovery of a salt dome in the Gulf Coastal plain in Lamar County, Mississippi, continues to gain momentum.

Acadian Production Corporation is moving in materials for a proposed 5000-foot wildcat test on a large block assembled around Section 25-2n-7e, Pike County, southeast of the town of Magnolia. The Texas Company and Sun Oil Company are among those reported to have taken spreads in the block which was gone over by geophysical instruments in October, 1936. D. H. Furse of Houston and G. C. Koch of New Orleans are among those interested in the proposed test.

Gulf Oil Corporation and The Texas Company have been adding to their holdings in George, Perry and Stone counties and Sun Oil Company has also had a land man in the same general area.

Phillips Petroleum Company has a geophysical party working in Perry County on part of the 250,000 acres on which this company recently took a geophysical exploration option. Sun Oil Company has a geophysical unit working in northern Lamar County and California Company has a reflection unit working for it in southwest Lincoln County, having sent a geologist temporarily to Brookhaven. Magnolia Petroleum Company has opened an office in New Orleans.

Reports are heard that a group of Shreveport independents are planning an early test on the Jackson Fault in southern Alabama.

Phillips Petroleum Company which had a geophysical crew working in the Mississippi delta in the northwest part of the state plans to drill two tests at an early date in Sunflower County, Mississippi.

Big Florida Lease

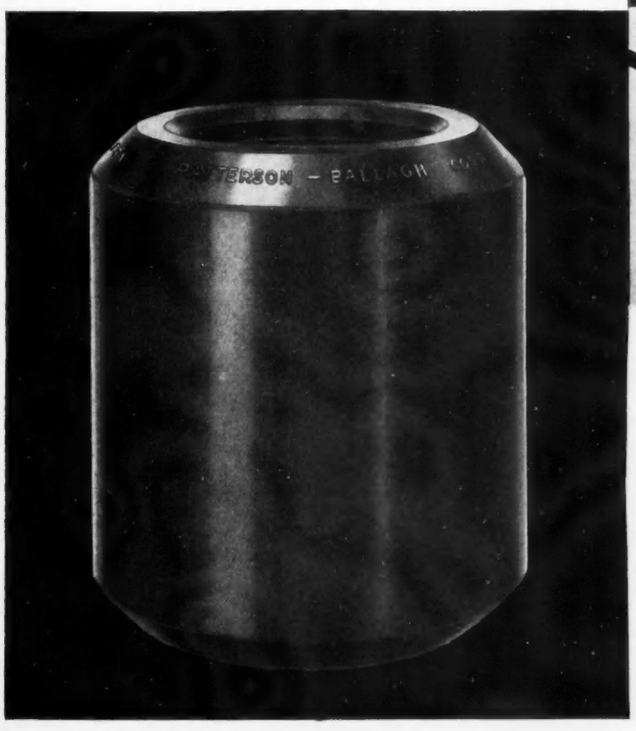
Fort Meyers, Fla.—Gulf Oil Corporation last week obtained oil leases on about 1,000,000 acres of land in Henry, Lee and Collier counties, Florida, following a transfer of the holdings from D. Graham Copeland of Everglades. The leases were filed March 30. The lessee agreed by terms of the leases to spend $8000 per month in geophysical prospecting for a period of at least 2 years.

Eight companies provided the land, with the Barron-Collier interests having been prominent in the transaction. Several wells have been drilled in the district during the past 10 years. C. S. Clarke of Shreveport, will be in charge of exploratory work.

Your drill pipe can "take it" at faster speed

In modern drilling, speeds are greater than ever before. Tool joints wear faster—a sure indication of increased casing wear. Strain on equipment is multiplied and therefore much more protection is needed than previously.

The simplest way to relieve equipment of excessive wear and strain is to install Patterson-Ballagh Casing Protectors. They eliminate contact between drill pipe and casing and the increased life of equipment will pay for installation during the drilling of a single well.



Extra-Long Protectors

These protectors are made in dimensions to fit every size of drill pipe, up-set drill pipe, Kelly subs and drilling stems. For drilling in large hole Patterson-Ballagh Drill Stabilizers are recommended.

The same drilling string, when equipped with these protectors, will drill many wells instead of a few.

Descriptive bulletins will be sent upon request.

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NEW MEXICO

Two wildcats prove 40-mile strip productive

* * *

New strikes insure continued Lea County work

* * *

Gas above oil horizons gives frequent trouble

Hobbs, N. M.—Two wildcats on the north end of the sandy-lime belt in eastern Lea County and parallel to the east flank of the dolomite lime areas extending from Jal to Monument have proved a large volume of acreage for oil production. This sandy-lime belt, averaging less than a township in width, extends in a general north and south direction and has oil production at intervals for a distance of about 40 miles. Comparatively few dry holes have been recorded on leases within the oil trend. Scattered producing areas in the belt have not been defined sufficiently to preclude the possibility of oil being found in commercial quantities for the entire distance. Variation of the lime and sand content of the formation is responsible for an occasional prolific oil producer being completed as an offset to sub-marginal wells.

New strikes in the sandy-lime belt will prolong continuous drilling in Lea County for a long period. The county was credited with 14 new operations the past week, and 16 oil wells were added by 7 separate areas during this period.

North of Eunice and Monument

Continental Oil Company et al's J. M. Skaggs 1, C NE SE 24-20s-37e, advanced oil production in the sandy-lime zone to the north and opposite the junction of the Eunice and Monument lime areas, with an initial flow of 21 barrels of 33 gravity oil per hour through ¾-inch choke after using 1400 gallons and repeating with 4000 gallons of acid in pay formation at 3791-3900 feet. The well is bottomed at 345 feet sub-sea. The last 20 feet of formation afforded the best saturation. An attempt to treat with acid at 3880 feet resulted in the displacement of only 218 gallons of the solution although pressures were stepped up to 1500 pounds on the tubing and 1900 pounds on the casing. Ajax Drilling Company, The Texas Company et al's J. P. Alexander 1, Lot 14, 5-21s-37e, 3¼ miles south by east of the above outpost producer, continued to flow by heads when deepened to 3755 feet, or 265 feet below sea level. It was reported last week as heading oil from top of pay at 3705 feet, and may be carried deeper before using nitro or acid.

Second for Lynn Area

The north portion of the Lynn field, which produces from a narrow dolomite lime structure between the Cooper and Eunice fields, scored a second well the past week. Continental Oil Company et al's Danciger 1-A-8, C NW NE 8-23s-36e, gauged 43 barrels of 34 gravity oil per hour on ¾-inch choke natural from pay at 3732-3790 feet, with an elevation of 3487 feet. It is a south offset to the same group's Ira C. Farley 1-A-5, which afforded a 2-mile north by west extension last December, and of equal production caliber. Since both wells produced natural the area is certain to command more development. Texas Pacific Coal & Oil Company holds lease on acreage lying immediately east of the two well sites.

Attaining a maximum flow of 525 barrels of 42.6 gravity oil in 24 hours while drilling ahead with cable tools under pressure, A. R. Eppenauer et al's F. B. Stuart-Amerada 1, NE NW NE 22-25s-37e, 1 mile from nearest production in the sandy-lime area east of Jal, encountered water at 3406-3410 feet. It has plugged back to 3400 feet, or 318 feet sub-sea, to test for water shutoff. It began flowing by heads at 3315-25 feet, and registered increased flow of oil and gas at intervals before reaching the water level. Sun Oil Company's I. B. Stuart 2, C SW NE 15-25s-37e, nearest test to the north, has cemented 7-inch pipe at 3157 feet.

Southeast Lea County

Magnolia Petroleum Company's Hanna 1, C SE NE 7-26s-38e, new wildcat project for the southeast corner of Lea County, is moving in rotary to drill to top of salt, and will then complete with cable tools. It is 1¾ miles east by north of Mid-West Exploration Company's A. Farnsworth 1, SW SW SW 12-26s-37e, which filled 2000 feet with oil at 3450-55 feet, and was abandoned in sulphur water at 4045-4115 feet in April, 1929. Improved drilling technique now employed plus the knowledge that the 3400-foot sandy-lime zone is capable of producing oil in commercial quantities probably would result in the successful completion of an oil well offsetting Farnsworth 1. The Texas Company's C. C. Fristoe 1, C SW NW 35-24s-37e, is a new operation to the northeast of Jal.

Blowouts Give Trouble

Frequent air and gas blowouts above the oil horizon in the Monument field are routine developments for rotary contractors. Repollo Oil Company's Barber 7, NE SW NW 8-20s-37e, an inside location, was giving stubborn resistance early last week after cleaning the hole of heavy mud at 2616 feet, with 9⅝-inch casing cemented at 2343 feet. Initial estimate placed the gas yield at 75,000,000 feet, but it was raised to 144,000,000 feet. Due to expansion, ice clogged the drill pipe, making it necessary to pump mud and water via the casing in trying to lubricate off the gas

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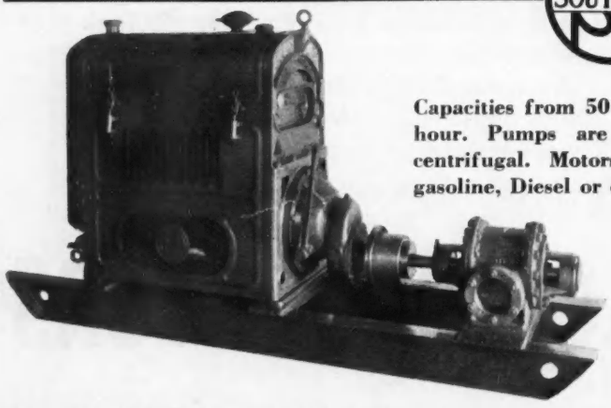

Capacities from 50 to 500 barrels per hour. Pumps are either rotary or centrifugal. Motors are either gas, gasoline, Diesel or electric.

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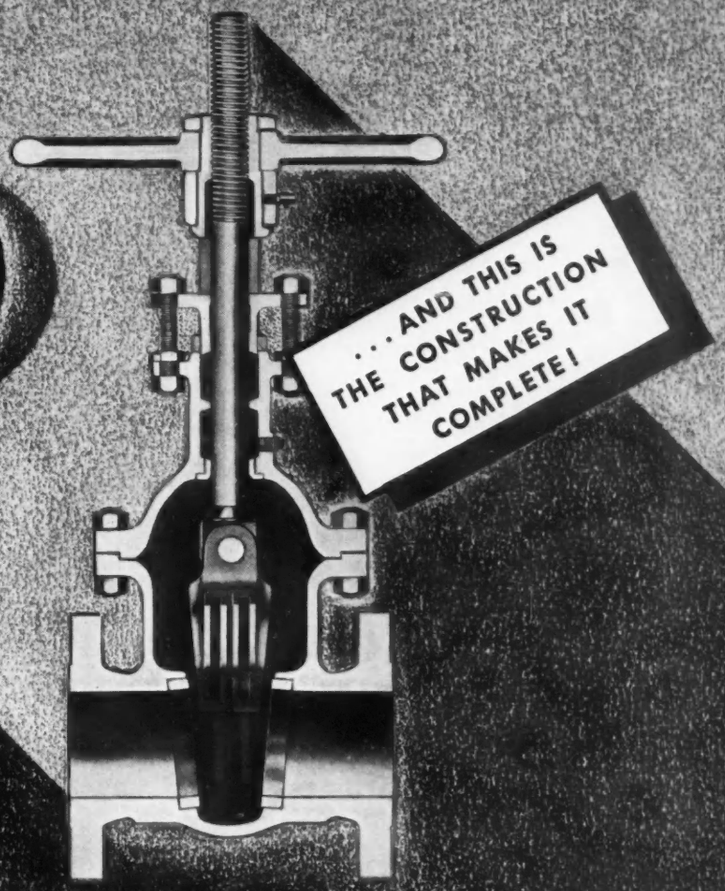

If you could see the actual inside of a Darling Valve, you would understand why Darling is another name for quality. In design, in materials, and in construction, Darling Valves have what it takes to give you dependable and economical operation.

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DARLING

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flow. These blowouts incur a big expense through loss of mud, and extra labor. Other drilling rigs sharing the same water supply are usually forced to shut down because of the entire water supply being diverted to the scene of the blowout.

Excepting two confusing letters, Amerada Petroleum Corporation has run through the alphabet in designating its various state leases in the Monument field. Letters N and Q have been omitted to avoid confusion. Five locations authorized the past week by the company follow: State 2-M, C NW SE 13-20s-36e; State 1-Y, C NE SE 17-20s-37e; State 2-Y, C NW SE 17-20s-37e; State 1-Z, C NE NE 13-20s-36e; and State 2-Z, C SE NE 13-20s-37e. By coincidence the remainder of the company's undrilled leases subject to early development do not include state permits. Amerada Petroleum Corporation's Laughlin 1, C NW NW 9-20s-37e, averaged 92 barrels per hour natural through 45/64-inch choke from lime at 3860 feet, with an elevation of 3562 feet. One of the three dry holes in the Monument field offsets the east end of this 160-acre lease.

The Texas Company's State-Lieu 6, C NW NE 20-20s-37e, located on the south end of the Monument area and within 1½ miles from the north end of the Eunice area, responded to treatment with 2000 gallons of acid at 3860 feet with a flow of 335 barrels of oil in 4 hours through open tubing. Late drilling authorizations included Continental Oil Company et al's A. U. Sanderson 4-A-11, NE SW SE 11-20s-36e, and Gulf Oil Corporation's State-Orcutt 2-D, C SW NE 13-20s-36e.

Finds Tight Lime

Atlantic Refining Company's State-Catron 5-L, Lot 4, 3-21s-36e, northeast outpost for the Eunice lime area, encountered tight lime and flowed 4 barrels oil per hour after 165-quart nitro shot at 3830 feet. It was deepened to 3845 feet without developing natural flow, and will be acidized. In the south portion of this field, Ohio Oil Company's State-McDonald 5, C SE NW 16-22s-36e, is exploring the lower lime section with drilling operations under way near the 5500-foot level. Trace of oil was logged at intervals below 5258 feet. New locations include Shell Petroleum Corporation's State 4-K, C NW NE 36-20s-36e, and Two States Oil Company and Southern Petroleum Exploration, Inc.'s McQuatters 3, C SW NE 11-21s-36e.

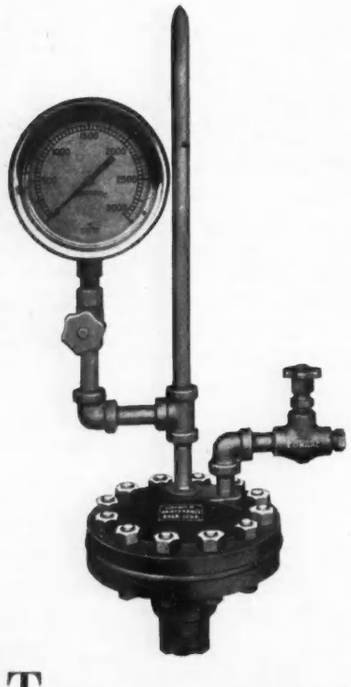
Maljamar Oil & Gas Corporation, discoverer and sole owner of production in western Lea County's only oil area, has started operations on Wm. Mitchell 3, C SE NE 20-17s-32e. It is a west offset to the company's Baish 8, which was recently completed flowing 50 barrels initial on air lift after two nitro shots in sand and anhydrite section at 2330-2352 feet. Oil produced in this area is moved by pipe line to refineries in the Artesia district.

Magonlia Petroleum Company's Will Cary 2, C NE SW 21-22s-37e, offsetting production in the Penrose-South Eunice sandy-lime area, flowed 104.44 barrels initial after nitro shot at 3620 feet. Tide Water Associated Oil Company's Walden 2, northeast offset, flowed 192 barrels after 300-quart shot at 3518-3610 feet. J. E. Farrell et al's Walden-Amerada 2-B, C NE SW 15-22s-37e, is rigging up standard tools, and Walden-Amerada 2-C, C SE SW 15-22s-37e, has moved in a machine.

J. W. Brown and Reynolds' Parcell-Conoco 1, eastern Lea County wildcat that showed little oil with water when lime at 4378 feet, or 805 feet sub-sea, was treated with 3000 gallons of acid, has deepened to 4390 feet without improving the oil level in the hole, according to reports.

Revival of interest in the Delaware lime and sand section immediately south of the New Mexico line in Loving County, Texas, is expanding into the former state. W. McCallister et al's Cagle 1, C NW NW 8-26s-30e, is a new Delaware prospect for southeastern Eddy County.

"MECO"
MUD LINE GAUGE
PULSATION
DAMPNER



THIS UNIT actually eliminates the turbulent pulsation which takes place in Mud Line Service. The extensive use for the past several years, plus the fact that at this time only a few drilling rigs operate without this dampner, proves the advantages of the "MECO" unit.

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NEW MEXICO
Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
LEA COUNTY (Eunice Field)—		
Gulf, H. C. Collins 4, c ne sw 14-21s-36e	105	3880
State-H. W. Leonard 5, c ne ne 22-21s-36e	850	3874
Two States Drlg. Co.-Union Oil & Mining Co., State 1, c se nw 11-21s-36e	375	3872
LEA COUNTY (South Eunice-Penrose Field)—		
Magnolia, Will Cary 2, c ne sw 21-22s-37e	117	3620
LEA COUNTY (East Jal-Mattix Field)—		
Plains Prod. Co. et al, Knight-Humble 4, c sw sw 22-24s-37e	250	3580
LEA COUNTY (Lynn Field)—		
Continental et al, Danciger 1-A-8, c nw ne 8-23s-36e	2500	3790
LEA COUNTY (Maljamar Field)—		
Maljamar O&G Corp., Baish 8, c sw nw 21-17s-32e	50	2352
LEA COUNTY (Monument Field)—		
Amerada, L. M. Lambert 4, c se ne 6-20s-37e	3000	3880
M. E. Laughlin 1, c nw nw 9-20s-37e	3000	3860
Continental et al, H. M. Britt 3-B-18, c nw se 18-20s-37e	960	3872
Gulf, State-Graham 4-F, c sw se 36-19s-36e	1200	3915
Oil Well Drlg. Co. et al, State-Wood 2, c w½ se nw 16-20s-37e	6000	3832
Repollo Oil Co., Barber 5, se se se 7-20s-37e	3600	3870
Skelly, Van Etten 3, c se sw 9-20s-37e	3500	3868
Texas Co., State-Lieu-Lands 6, c nw ne 20-20s-37e	2500	3860
LEA COUNTY—		
Continental et al, J. M. Skaggs 1, c ne se 24-20s-37e	900	3900

*Failures; †Junked; ¶Million cu. ft. gas.

CONFERENCE CALLED
Mineral Industries to meet October 8 and 9

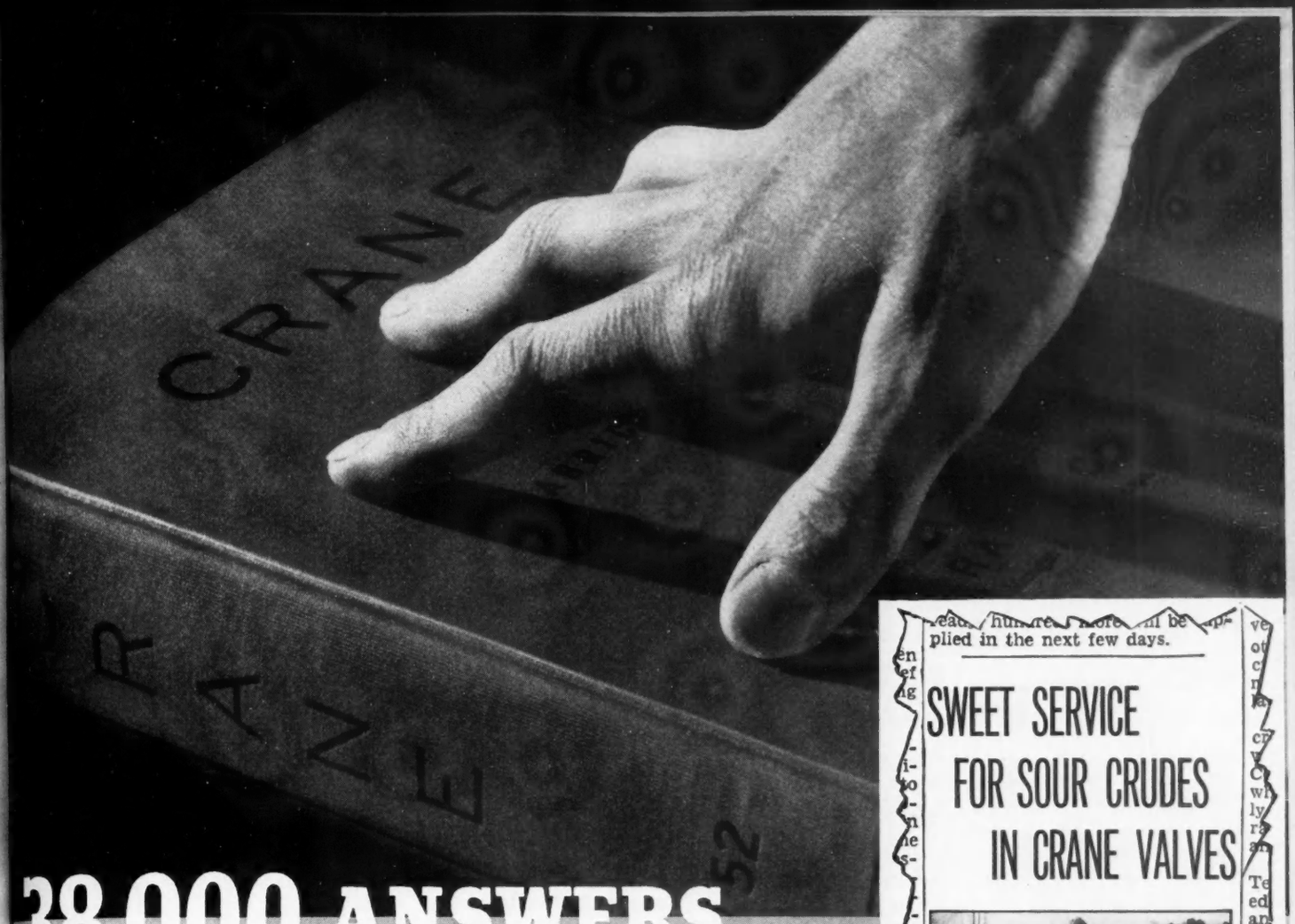
Chicago.—Departing from the regular practice of an annual spring meeting, the fifth annual Illinois Mineral Industries Conference will be held at Urbana, October 8 and 9, according to information received from the office of M. M. Leighton, chief of the Illinois State Geological Survey.

In announcing the dates for the 1937 conference, Dr. Leighton indicated that all future meetings will probably be held in the fall, because of the fact that many people connected with the mineral industries of the state have not been able to attend some of the previous meetings, due to conflicts with other meetings involving their special fields of interest. The October dates were selected after conferences with a number of representatives of these industries.

Announcement of the program will be made later this spring.

TAKE OVER PLANT

Mission, Texas.—Fordyce Refining Company has been organized by J. F. Roark and Ed. W. Sullivan, president and vice president respectively, to take over and operate the 1000-barrel capacity crude skimming plant at Sullivan City, originally built in 1935 by the Sullivan City Oil & Refining Company.



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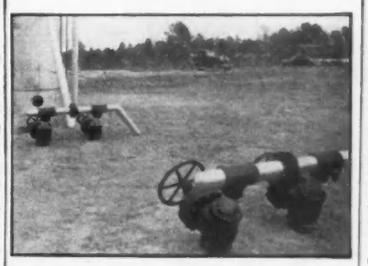

HOUSTON, TEX., Mar. 26—Whether your problem is sour crude, abrasive sand, or bottom hole pressures, any other of the thousand and one troubles of the oil industry, Crane has a valve that will solve it.

Crane has grown up with the oil industry and knows its problems from earliest wooden derrick days to the present era. Crane has been solving "hot spot" problems since oil men first used that term. Our research engineers for years have been busy finding metals that would handle safely the temperatures, pressures and corrosive problems of the industry.

Crane makes valves and fittings of forged steel, cast steel, malleable iron, special alloys, cast iron, brass. Every metal is treated as a specialty at Crane although it may have long been used in a regular line of Crane valves for generations. That's one reason why Crane valves and fittings are tops in the services for which they are recommended. CranEquip wherever you need a valve or fitting. It's the easy way to stop your valve trouble.

ROCKY MOUNTAIN FIELDS

Drilling increase follows waning of cold wave

* * *

Nebraska reports show of oil and gas

* * *

Utah wildcat drilling plug to test show

Casper, Wyo.—As March went out like a lamp throughout the Rocky Mountain states generally, drilling activity made a sharp upswing in the northern oil division. This included the resumption of three wildcats drilling in Nebraska, two wildcats at critical depths in Utah, strengthened activity in Wyoming proved fields, and a considerable increase in the Cut Bank and Kevin-Sunburst fields which had been virtually shutdown for two months in one of northern Montana's most rigorous winters.

Two Finished at Lance Creek

Two wells completed in Lance Creek, Niobrara County, eastern Wyoming. Continental Oil Company's Schuricht 3-B, CSE SE 6-35n-65w, and inside location in the southwestern part of the field, completed for 80 barrels per hour open through 7-inch casing and 60 barrels per hour through 2-inch tubing. It logged basal Sundance sand at 3931-4071 feet, with the production string set on top of the sand. Ohio Oil Company's Lamb 9, CSE NE 5-35n-65w, an important recompletion, gauged 30 barrels per hour from the basal sand at 4050-90 feet. The well completed originally six weeks ago at 4050-72 feet for around 400 barrels daily. It is in the southeastern part of the field. It is expected deepening will take place in several other wells completed in that immediate area which penetrated only a small section of the Sundance sand.

Trying Extension

East of Lance Creek's limits, Ohio Oil Company's Leo-5 OPC-16, NW NW SW 35-36n-65w, is nearing a critical depth, drilling in the basal sand at 4268 feet. The company has released location for Leo 1 OPC 17, NW NW SE 35-36n-65w, and is preparing to deepen its Putnam 6, NW NW 4-35n-65w, below 4019 feet. Putnam 8, SW SE SW 33-36n-65w, is drilling at 1573 feet.

Mackinnie Oil & Drilling Company's Thompson 2, NW NW NE 7-35n-65w, an outside location on the southwest and a south offset to the A. B. Cobb's Novick 1, which last week extended Lance Creek a quarter mile to the southwest, is rigging up rotary equipment.

North and east of Sundance oil production, J. M. Huber Corporation is fishing to recover 4¾-inch liner at 3549 feet in Midwest 1, SE SW 27-36n-65w, which completed several years ago for a gasser in the top of the First Sundance sand.

In the southeast extension to Allen Lake gas field, Carbon County, Ohio Oil Company has released location for Union Pacific-Wister, CNW SW 17-22n-78w, an east offset to the Medicine Bow Oil Company's Hintze-Government 1, CNE SE 18-22n-78w, which completed in December for 25,000,000 cubic feet of gas daily in the First Sundance sand at 2033-58 feet. Hintze-Government 1 is coring at 2084 feet for the basal Sundance sand in a test for oil.

Change to Repressure Well

A deep test to Tensleep sand in Rock River, Carbon County, Wyoming, has been

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OPERATES AS EASILY AS DRIVING A CAR. Every operation is maintained by a METERED VACUUM SYSTEM — never affected by temperatures, small leaks or water in the lines. The touch and feel of each lever — so essential to accurate operation — is there. All operator's movements are practically effortless. The Clipper has the handiest, most comfortable cab on any machine, with full vision safety glass windows — and it has METERED VACUUM CONTROL.
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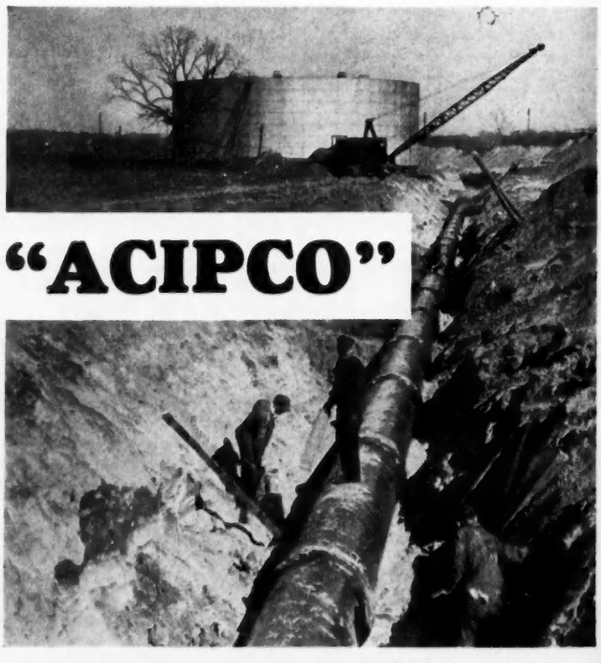

36" Mono-Cast Centrifugal Pipe being installed in sewer line conveying oil refinery condenser water from oil trap to river. Soil conditions hereabouts are very bad, and photo indicates heavy backfill necessary in this instance. Installations like these exemplify the many advantages of modern cast iron pipe. For literature address American Cast Iron Pipe Company, Birmingham, Alabama.

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And there's every reason to agree with this estimate of the perfect *pre*formed line. Every wire in this line is drawn precisely uniform, through Williamsport's unvarying Carboloy dies. The line is prelubricated with a permanent compound available only through Williamsport and it's tested and certified with Telfax Tape, for your protection. Every inch is built right in our own plants by men and machines building wire lines and *nothing else*. No wonder good drillers come to depend on "Form-Set", Williamsport's *pre*formed wire line.

Rugged, tough, yet easier to handle, "Form-Set" belongs on your rotary job. Priced the same as all *pre*formed line, it often figures less cost by doing more work. For best results, good drillers use Purple Strand "Form-Set".

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General Machine & Tool Co., Distributors in Kansas.
American Pipe & Supply Co., Distributors in the Rocky Mountain Territory.

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plugged back to the Dakota sand for a gas repressure well. Ohio Oil Company's Harrison-Cooper 7, CNW 2-19n-78w, found the Tensleep dry at 5630 feet, but is believed to have drilled into steep dips and off the sub-surface structure. Rock River, which has produced 16,500,000 barrels of oil from the Dakota since its discovery in 1917 and which was discovered for commercial production in the Sundance two years ago, will probably see a second test to the Tensleep sand. Ohio's Harrison-Cooper 1, SE SW 35-20n-78w, another old Dakota producer, deepened to the Sundance at 3225-3325 feet and completed this week for 25 barrels daily on the pump.

On Quealy Dome, Albany County, California Company's Holst-Woolf 1, CNW NW NW 19-17n-76w, is drilling at 371 feet; its Wilson 3, SW NW SW 18-17n-76w, is drilling at 2103 feet.

In Big Medicine Bow, Carbon County, Ohio Oil Company and California Company's Union Pacific-Cronberg 4, CSW SW 25-21n-79w, is drilling at 2944 feet. Their William Kyle 2, CSE SE 26-21n-79w, is drilling at 4045 feet.

In Natrona County, Empire State Oil Company's Unit-3, SE NE 33-34n-84w, an old well deepening to lower formations in South Casper Creek, is waiting on cement to set around the 5⅜-inch casing at 2265 feet on top of the Embar lime.

1500-Barrel Garland Well

The Stock Oil Company completed Allen 1-B, SE NW 35-55n-97w, Garland, Big Horn County, northern Wyoming, for 1700 barrels in 16 hours through the casing and 1500 barrels daily 2-inch tubing with ½-inch choke. It developed production in Madison lime at 3093-4176 feet and deepened to oil production after being used as a relief hole to stop the flow of gas in Allen 1, wild gasser which was recently brought under control.

In Byron, Ohio Oil Company's State 1, NEc 35-56n-97w, is testing 10 barrels per hour after acidizing in the Embar lime at 5418 feet. The company's Baker-Byron 1, SE NW 23-56n-97w, is drilling in sandy shale at 4183 feet.

Two to Start at South Baxter

Mountain Fuel Supply Company this week released location for two wells in South Baxter Basin, Sweetwater County, southwestern Wyoming. They are Union Pacific 1, NE 29-16n-104w, and Union Pacific 3, NE 15-16n-104w. The company's J. C. Donnell 1, NE SE 31-12n-97w, Powder Wash, Moffat County, Colorado, is drilling at 2344 feet.

Recent developments in the Tri-State basin outside Powder Wash include the starting of a test on South Vermillion Creek structure, also in Moffat County, northwestern Colorado. This test will be spudded April 1 by Anderson-Kerr Drilling Company. It will be carried to the Tertiary beds, which have proved prolific in Powder Wash. The well will be drilled with rotary tools and operators expect to find the objective beds about 600 to 700 feet deeper than is the case in Hiawatha field, located about six miles north.

A block of 20,000 acres has been assembled by the interests with which the Anderson-Kerr Drilling Company is affiliated. Location for the test has not been released although it will probably be in SW¼ SW¼ 16 or SE NE 17-11n-100w.

Nebraska Wildcat Reports Show

Nebraska wildcat tests were showing considerable progress during the week and operators on one of the tests report showings of oil and gas. The well is located on the North Platte structure, Lincoln county, in the southwestern sector of the state and is Smith & Wright's Hansen 1, CSW NW 24-15n-31w. It is drilling at 1200 feet in gray shale, in which the shows were reported. Samples taken from 400 feet have been sent to Lincoln for identification.

In Sioux County, on Antelope anticline, J. M. Huber Corporation's Morgan 1, CSW SW 32-35n-56w, is drilling below 2700 feet.

Stephens Petroleum Corporation's S. J. Palmer 1, NW SW 10-35n-50w, first of the Nebraska wildcats to resume operations this spring, is reported drilling below 1855 feet. The well is located on the Dakota Junction structure, Dawes County, in the western sector of the state.

Utah Wildcat Cements String

Columbia Crude Corporation's Rath-Government 1, NE SW 12-25s-20w, Seven Mile Dome structure, Grand County, Utah, has cemented a seven-inch casing at 2132 feet for water shut off and is preparing to drill in to test oil shows encountered at 2138 feet. Shows were found several weeks ago, but constant flooding of the hole from a water stratum above the oil sand has delayed completion.

Northern Montana this week forged rapidly ahead from the point at which it was left several weeks ago when the cold weather forced a complete shut-down of activity. Cut Bank field, Glacier County, showed an excellent completion this week. Glacier Production Company's Seeba 5 made 186 barrels of oil per day initially. Glacier Production Company also completed its Abraham 1 for 150 barrels. Three new wells were started in each of the two major producing fields, Cut Bank and Kevin-Sunburst.

A price change was made effective this week in Cut Bank where Northern Refining Company contracted for the entire crude production of Santa Rita Oil & Gas Company in that field. The price accepted for the crude is quoted at $1.26 per barrel as compared with $1.40 per barrel quoted field price. Possibility that gasoline prices for the area may shift to Mid-Continent levels with the change in crude price was seen. The new price is effective only in the deal between the Santa Rita and Northwestern interests, affiliated companies. Operators in the area made no comment on the expected effect of this change on other prices in the field.

COLORADO TO CRACK

Chicago.—The first Dubbs cracking unit ever to be built in Colorado is to be installed in the Denver refinery of the Bay Petroleum Corporation, it is announced here. A license agreement with Universal Oil Products Company has been signed by M. H. Robineau, Bay president, and construction work is to start at once.

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MOUNTAIN STATES
Completions

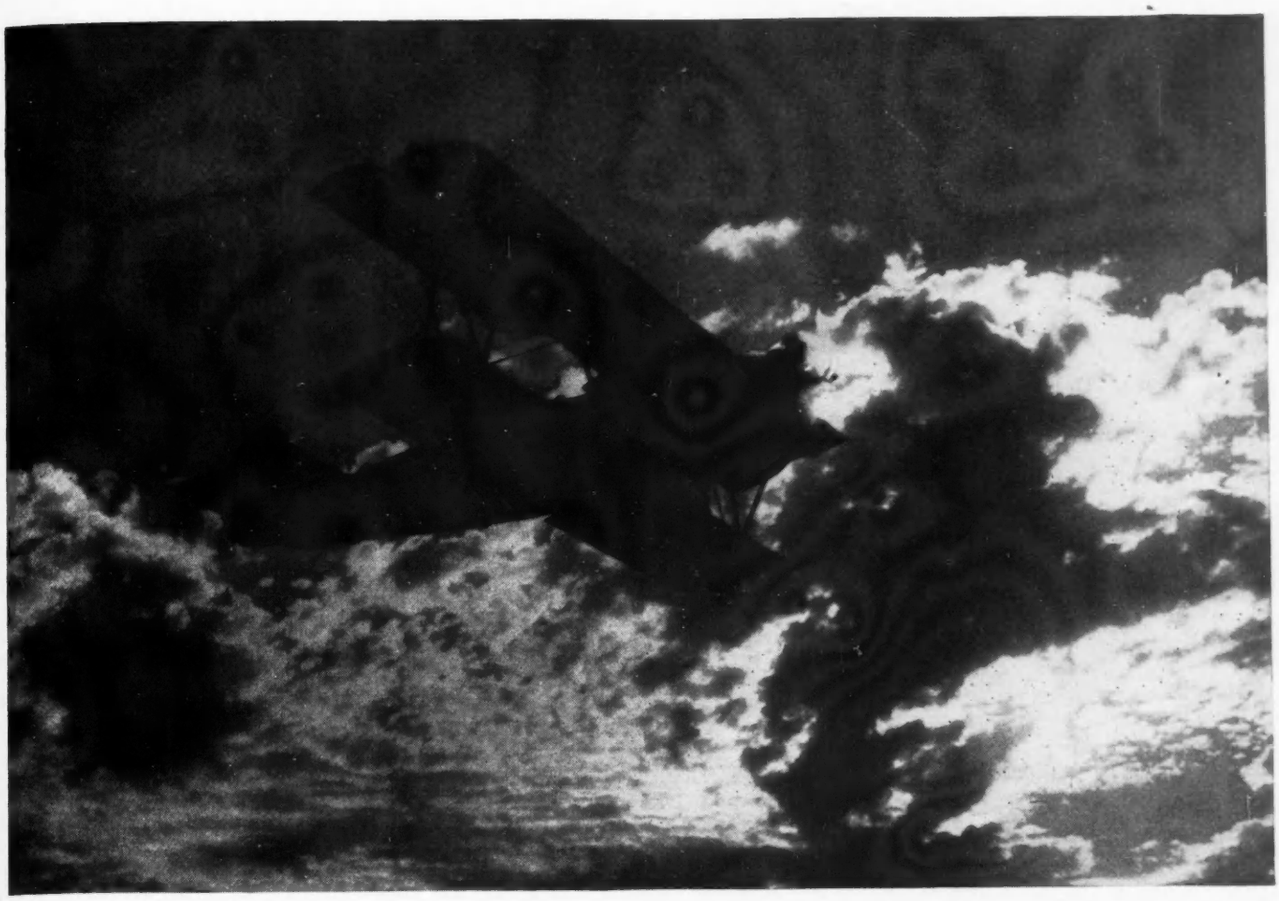
MONTANA

Company, Well and Location	Init. Prod. Bbls.	Depth
GLACIER COUNTY (Cut Bank Field)—		
Glacier Production Co., Williams 1, csw se 21-33n-5w	44	2937
TOOLE COUNTY (Kevin-Sunburst Field)—		
Wm. Fulton, Thompson 1, nw sw ne 28-35n-3w	15	1700

WYOMING

NIOBRARA COUNTY (Lance Creek field)—		
A. B. Cobb, Nat Novick 1, ne se sw 6-35n-65w	960	3990
WESTON COUNTY (Osage Field)—		
Wheedon Oil Corporation 19, swc 16-46n-63w	1	415
Charles Stough 5-X, cnw nw 4-46n-63w	*	300
6-X, cnw sw 4-46n-63w	*	305

*Failures; †Junked; ¶Million cu. ft. gas.



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CALIFORNIA FIELDS

El Segundo producer largest since 1934

* * *

Wilmington busiest field in state

* * *

Three tests drilling below 10,000 feet

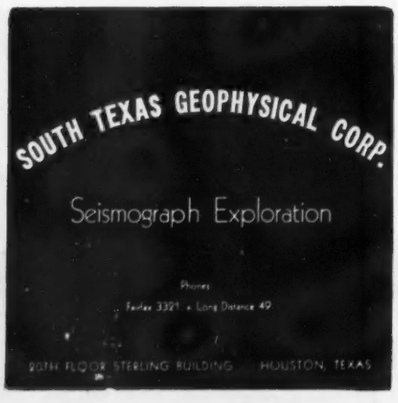
Los Angeles.—Completion by The Texas Company of Security 1, El Segundo, Los Angeles County, last week for 4196 barrels of 27.6 gravity clean oil at 7255 feet gave the state its largest producer since December, 1934, when Fourl's first well came in at Playa del Rey for 5000 barrels. The Texas Company's well extended the new field 500 feet west.

A string of 8⅝-inch casing was cemented at 7167 feet, and 142 feet of 6⅝-inch liner, including 89 feet of perforated, was landed on bottom. The well is making 3,866,000 cubic feet of gas, with 760 pounds on the tubing and 1100 pounds on the casing. The gas is capable of yielding 2.5 gallons of natural gasoline per 1000 cubic feet.

Union Oil Company's El Segundo 1, total depth 7685 feet, with 7⅝-inch casing cemented at 7646 feet, came in for 1150 barrels while making a water shut off test. The well was killed and 105 feet of 5¾-inch liner, including 39 feet of perforated, was run. Then the well gauged 1050 barrels of 26.5 gravity oil, cutting 5 percent, through a 28/84-inch bean, accompanied by 650,000 cubic feet of gas. Production buitl up to 1266 barrels of 26.5 gravity oil, cutting 11 percent. This is another outpost well for the field, extending the producing territory some 1500 feet southeast.

Four on Production

Eight wells are active in El Segundo and there are five locations staked, two of which will be drilling in a few days.



Only four wells are on production. Richfield Oil Company's El Segundo 1, discovery well for the field, is making 1171 barrels of 27.3 gravity clean oil, with bottom of hole at 7435 feet. Richfield's El Segundo 2 is making 618 barrels of 27.7 gravity oil, cutting less than one percent. Ohio Oil Company's A. S. Gough 2 is flowing 280 barrels of 28 gravity clean oil with bottom of hole at 7341 feet.

Wilmington Is State's Busiest

Wilmington, between Long Beach and San Pedro in Los Angeles County, is the busiest field in the state, with a total of 71 operations. There are 22 drilling wells, five ready to spud, 15 rigs up and 29 locations. Wells in this field are being completed between 3500 and 4000 feet. Strings of 8⅝-inch casing are being cemented close to 3500 feet, and in several instances strings of 11¾-inch and 13⅜-inch casing are being landed at about 2500 feet. Surface pipe of 20-inch diameter is usually set at from 80 to 100 feet.

Union Pacific Railway Company leads other concerns in number of holes drilling and preparing to start. Union Pacific is now actively drilling 5 holes, has 15 rigs and locations. Every hole to be drilled by Union Pacific is an offset, since its leases are in small tracts, forcing a hurried campaign to prevent drainage.

General Petroleum Corporation is also very busy at five drilling wells and preparing to start at once at least five more holes. This company brought in the first producer for Wilmington and then added to its acreage, securing a lease on a large tract owned by Ford Motor Company. A. T. Jergins is also getting busy with one hole ready to spud and seven locations. Royalty Service Corporation is drilling three holes and getting ready to start six more. Fourteen other companies are either preparing to start new wells or are already drilling.

Discovery Well Flow Higher

The discovery well for the new field near Newhall in Los Angeles County, drilled by Barnsdall Oil Company, has increased production to close to 800,000 feet of gas and 400 barrels of 26 gravity oil, cutting only four percent. Bottom of the hole is at 6472 feet, with 8⅝-inch casing cemented at 6160 feet.

Since Barnsdall Oil Company holds several thousand acres surrounding the new well, leasing is not very active, although other companies and individuals are securing leases as near as they can get to the well, but are not paying big bonuses.

Fruitvalle, in Kern County, is rather active with 13 drilling jobs and two rigs up. Three new wells the past week had a total initial of nearly 700 barrels. Western Gulf Oil Company's A. C. West 2, depth 3952 feet, with 8⅝-inch casing cemented at 3851 feet, recently tested good for 680 barrels, but water broke in and it must be worked over. This test is in Section 21-29-27.

Three Deep Ones

At Santa Fe Springs, Union Oil Company's Bell 100, deepest hole ever drilled in Southern California, has reached 10,678 feet. Practically no mechanical trouble has been encountered. It is drilling in shale with streaks of sand, and showings of oil and gas continue to appear on the ditch.

Although no announcement has been made to that effect by the company, it is understood the hole will go to 12,000 feet, if no producing sand is found before, and if no mechanical difficulties are encountered.

Another hole in California, in the general Ten Section area of Kern County, is bottomed at 10,409 feet, and is standing with a string of seven-inch casing cemented at 10,380. This hole is being drilled jointly by Superior Oil Company and Union Oil Company in section 11-30-26. In the Lerdo area of

CALIFORNIA Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
EL SEGUNDO—		
Republic Prod. Co., No. 3	150	7400
Richfield Oil Co., No. 4	135	7535
Royalty Service Corp., Buffington 1	500	7287
Texas Co., Security 1	4198	7253
Union, No. 1	1260	7685
PLAYA DEL REY—		
Union, Del Rey 16	110	6099
RICHFIELD—		
Union, Chapman 44	260	3465
Chapman 45	170	3469
WILMINGTON—		
Bankline Oil Co., Class. Yards 1	125	3547
General Pet., Eubank 4	250	3622
Geo. F. Getty, W-3	600	3575
Royalty Service 22-7, 1	500	3623
Seligna Associates, No. 1	600	3588
V. R. A. Wilbur, Mutual 1	130	3592
PUENTE—		
Honolulu Oil Corp., Newhall Land 1	*	4936
FRUITVALE—		
Edward Gieck, Greeley 1	440	3136
Magnet Oil Co., Anderson 4	150	4201
Trico O&G Co., Knowles 1	100	3202
Pal Pen Oil Co., Barbara 1	*	3153
MIDWAY SUNSET—		
Berry Holding Co., Hillside 21	50	830
Hallmark Oil Co., Fried 6	500	2830
Richfield Oil Co., Fellows 8-A	50	1309
Standard, No. 39-23D	250	3708
52-33D	525	2985
Tide Water Associated, No. 31	40	1329
Texas Co., Midway 19	300	2890
TEN SECTION—		
Shell, K.C.L. A, 78-30	2500	8475
GATO RIDGE—		
O. C. Field Gaso. Corp., Continental 1	500	3380
SHIELLS CANYON—		
Texas Co., Shiells 132	200	3123
SOUTH MOUNTAIN—		
Honolulu Oil Corp., Hobson 1	45	3600
KERN COUNTY—		
Bear Mountain Oil Co., Tejon 1	*	1669
La Canada Oil Corp., R. I. Estate 2	*	1399

*Failures; †Junked; ¶Million cu. ft. gas.

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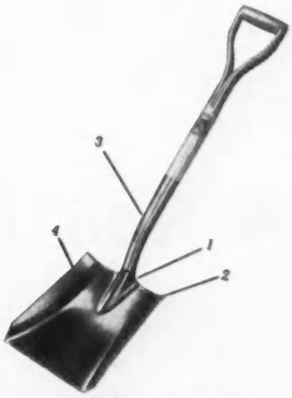

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Kern County, Arkelo Petroleum Company's well is bottomed at 10,056 feet and is fishing.

Union Oil Company's Callender 50 in the Dominguez field, the deep test of the old field, is now making hole slightly below 10,060 feet. Last pipe cemented was 8⅝-inch at 6860 feet. The company's Carson 9 in the same field is bottomed at 7303 feet and 8⅝-inch is cemented at 7190 feet.

In the Rosedale area in Kern County, Section 8-27-24, Continental Oil Company's Kern County Land A-1, is now bottomed at 9540 feet. Bailer was lost in the hole but has been recovered and the hole has been cleaned out to 9303 feet, where four-inch casing is cemented. Just how much deeper this hole will be drilled is not known.

In the new Greeley field in Kern County, Standard Oil Company of California, discoverer of the field, is drilling four holes, all below 7400 feet, and two more holes are to start at once. The company has considerable acreage under lease in the general area. Standard's No. 11-2, Section 20-29-26, stopped drilling at 7824 feet, in gray sand and cemented nine-inch casing at 7725 feet. No. 12-1, Section 30-29-26, is coring at 7835 feet in shale.

DREW ON STOCKS

Los Angeles. — Net withdrawal of stocks of all crude and products in California during February was 461,815 barrels, according to the American Petroleum Institute report for that month.

Slightly more than 1,000,000 barrels of heavy crude, including fuel oil, was taken from storage, while 30,152 barrels of light crude was withdrawn. Storage of unblended natural gasoline and motor fuel was increased 1,074,000 barrels.

EASTERN FIELDS

Illinois to be busy district for few months

* * *

Deep test in Pennsylvania still holds interest

Pittsburgh. — Activities in Eastern fields are steadily increasing, despite mud roads that make progress difficult in many sections. Wells shut down during the past two months due to floods and unfavorable weather are drilling again.

The basin area of Illinois will be the scene of most new work during the next few months. Drilling activity by many companies in that region is getting under way following almost a year of exploration and research by major companies. Whether many wells will be drilled to 6000 and 7000-foot depths, outside of the few tests scheduled for those levels and now underway by major companies, will depend on whether operators continue to find oil in paying quantities in upper formations.

Watching Pennsylvania Test

Failing to complete last week, the deep test of William Snee and others on the Summit Hotel lease on Chestnut Ridge, south Union Township, Fayette County, Pennsylvania, remains one of the most interesting tests drilling in the east. It is a sidetrack job on a former test where gas volume was in excess of 500,000 cubic feet at 6611 feet. As it was impossible to run casing in the old crooked hole, the test now drilling left the old hole at about 4250 feet. The tools were drilling in dark lime and chert at 6645 feet in the wildcat, with progress slow because of the hard formation. No sand has been found thus far.

Large for Lima Field

D. B. Davis brought in one of the largest producers to be completed in Lima field, Ohio, for some time on the Carl Foltz farm, Section 8, Eagle Township, Hancock County. The third test on this property, it made 35 barrels the first 24 hours after a shot and is expected to stimulate activity in that section.

In southeast Ohio, the Preston Oil Company completed Sunday Creek Coal Company 1624 in the northeast quarter of Section 22, Ward Township, Hocking County. Drilled into the Clinton sand at 3416 feet, it produced 40 barrels the first day after a shot.

Another 40-barrel producer was Bell & Company's S. & C. Seidenfield 3, Section 36, Coal Township, Perry County. It was drilled through the Clinton sand at 3681-3716 feet, with a break in the sand from 3701-06 feet, to a total depth of 3722 feet.

Record Ohio Gasser

The largest Ohio gasser was that of East Ohio Gas Company on the J. W. Lebold farm, Section 3, Sandy Township, Tuscarawas County. It was drilled through the Niagara lime at 3050-4548 and completed 1 foot below the Clinton sand, found at 4764-95 feet. It gauged 4,000,000 feet after a shot.

Only one producer of any importance was completed in West Virginia. Drilled by the South Penn Oil Company, Haught Lambert 19, Murphy district, Ritchie County, is showing for 25 barrels a day from 1960 feet. Other West Virginia producers were completed by Guy B. and A. C. Patterson on the W. B. Patterson tract, Liberty district, Marshall County, good for 1½

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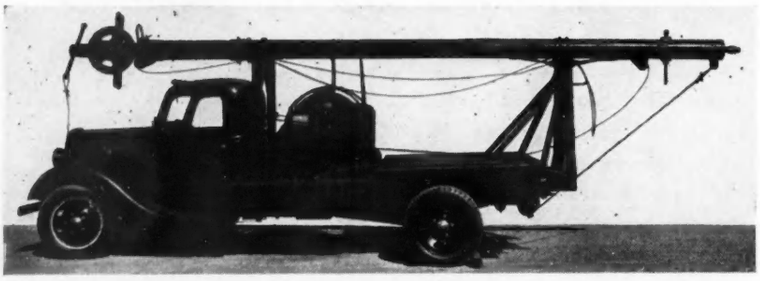

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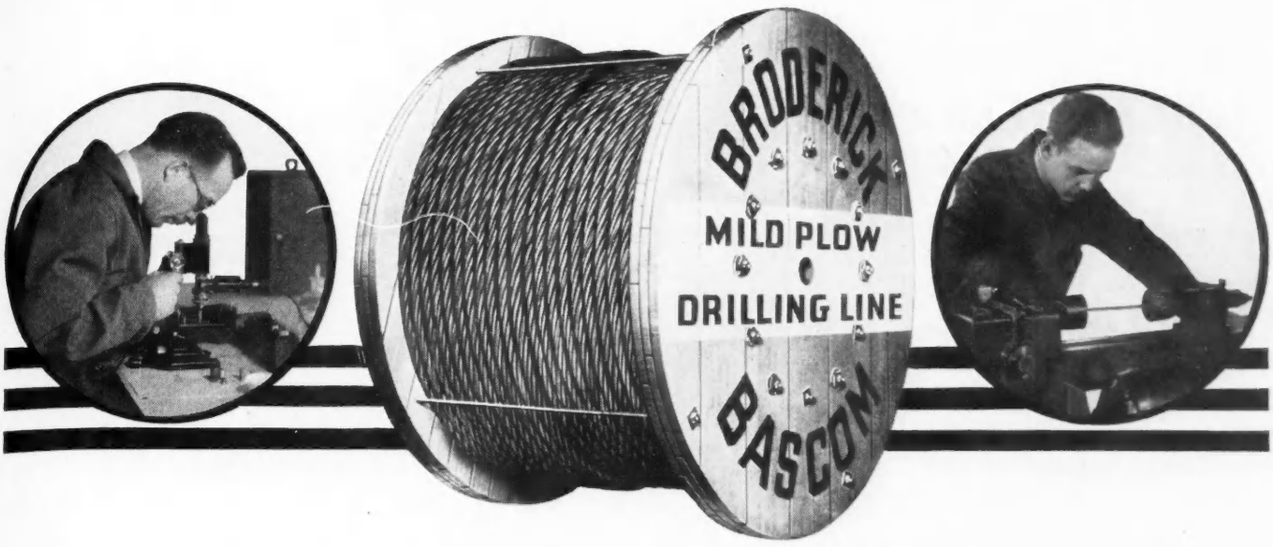

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barrels a day, and by Simon Axelrod and others on the H. Sunderman farm, Washington district, Pleasants County, which is good for one barrel a day.

G. L. Cabot, Inc., completed the test on Lee Harder 2 farm, Alma Township, Allegany County, Pennsylvania. In the New York-Pennsylvania deep sand gas field, this well gauged 27,000,000 cubic feet per day with an initial rock pressure of 1540 pounds. It topped the Oriskany sand at 4681 feet and registered the first show of gas at 4686 feet. Four feet lower, the flow had increased to 19,000,000 cubic feet, and later increased to 24,000,000 feet.

EASTERN FIELDS
Completions

Company, Well and Location	Init. Prod. Bbls.	Depth
OHIO		
ASHLAND COUNTY—		
Kline & Co., Charles Crittenden....	¶	570
GUERNSEY COUNTY—		
George Jewell, C. A. Harper et al 1	¶	1101
Henry Armstrong 2	¶	1084
George Kernodle, Walter Burnsworth 1	¶	1208
Joe Flannery, J. & R. Atkinson 1	*	1321
HANCOCK COUNTY—		
D. B. Davis, Carl Foltz 3.....	35	....
HOCKING COUNTY—		
Preston Oil Co., Sunday Creek Coal Co. 1624	40	3416
HOLMES COUNTY—		
Ohio Fuel Gas Co., Eli Yutzy 1..	¶	4055
LICKING COUNTY—		
Wehrle Gas Co., John Murphy 1...	4	750
MEDINA COUNTY—		
Obermiller Bros., W. Szoke 1.....	¶	2852
E. R. Edson & Son Co., Ray & Cora Koons 3	*	571
MEIGS COUNTY—		
Ohio Fuel Gas Co., Bart Romaine 1	*	1739
MONROE COUNTY—		
A. H. Anderson & Co., William Mahoney 2	*	1625
F. C. Parks, Pearl Parks 3.....	*	560
Hill Oil & Gas Co., Ben F. Dye, Sr., 7	¶	1655
A. J. West & Co., Susan Crossley 1	*	1491
MORGAN COUNTY—		
J. V. Bowman, Oliver Edgerton 3..	¶1	723
MUSKINGUM COUNTY—		
H. B. Walker & Co., J. W. Riley 2	*	3498
PERRY COUNTY—		
Bell & Co., S. & C. Seidenfield 3..	40	3716
Wehrle & Daily Crude Oil Co., Robt. Deaver 5	¶	1230
SENECA COUNTY—		
R. D. Perkins, Rufus Martin 1.....	15	1444
C. J. Minor, Russell Martin 3.....	¶	1445
TUSCARAWAS COUNTY—		
East Ohio Gas Co., J. W. Lebold 1	¶4	4796
WASHINGTON COUNTY—		
Wm. Dupuy, George & Julia Heldman 1	8	1947
WEST VIRGINIA		
CABEL COUNTY—		
Toms Creek Gas Co., J. A. Morrison 1	¶	3550
HARRISON COUNTY—		
Delaware Gas Co., Anita Goff 1...	¶⅓	3390
KANAWHA COUNTY—		
Benedum & Trees, John Slack Heirs 1	¶	4935
LINCOLN COUNTY—		
Huntington Development & Gas Co., Ulysses Bellamy 279.....	¶	3510
Nine Mile Gas Co., Ella Adkins 1	¶	3027
United Fuel Gas Co., Mohler Lumber Co., 4674	¶⅓	4476
W. C. Kingery et al, J. W. Smith	¶	2075
MARSHALL COUNTY—		
Guy B. and A. C. Patterson, W. B. Patterson 2	¶1½	3306
PLEASANTS COUNTY—		
Simon Axelrod et al, H. Sunderman 1	1	825
RITCHIE COUNTY—		
South Penn Oil Co., Haught Lambert 19	25	1960
W. H. Mosser, Andrew Prather 2	¶¼	1966
Creed Barker, Henry L. Barker 2.	¶1/5	2000
WETZEL COUNTY—		
Carnegie Natural Gas Co., Clarence Blatt 2	¶	2478
Columbian Carbon Co., Franklin Fitzsimmons 1	*	2185
PENNSYLVANIA		
ALLEGHENY COUNTY—		
G. L. Cabot, Inc., Lee Harder No. 2, 1	¶27	4690
GREENE COUNTY—		
Carnegie Natural Gas Co., Ella B. Parker	¶	2860
Equitable Gas Co., E. & M. Cole 1	¶	3304
WARREN COUNTY—		
Potter Development Co., Lessor & Launer 1	*	4928

*Failures; †Junked; ¶Million cu. ft. gas.

Warren County Test Fails

The third Warren County, Pennsylvania, test of recent weeks in this field was abandoned when Potter Development Company stopped drilling on the Lessor & Launer farm, Kinzua Township, at 4928 feet. It had a showing of 116,000 cubic feet per day when drilled into the Oriskany at 4711 feet, but the showing failed to increase after a 35-quart shot. The hole was deepened without any additional flow. Current operations in this gas field consist of three wells drilling, one shut down, and a new location staked in Potter County; one shut down and one new location in Warren County; two drilling and one shut down in Tioga County; one down in Venango County, and one drilling and one rig building in Crawford County, all Pennsylvania; in the New York side of the field, two wells drilling in Allegany County, three drilling in Steuben County, and one shut down and one rig building in Cattaraugus County.

Two gas wells were completed in southwest Pennsylvania. Carnegie Natural Gas Company completed a test on the Ella B. Parker farm, Dunkard Township, Greene County, at 2860 feet. It has been shot and will be cleaned out. Equitable Gas Company deepened E. & M. Cole 1 to 3304 feet. It gauged 142,400 feet of gas a day, when tubed, and is in Wayne Township, Greene County.

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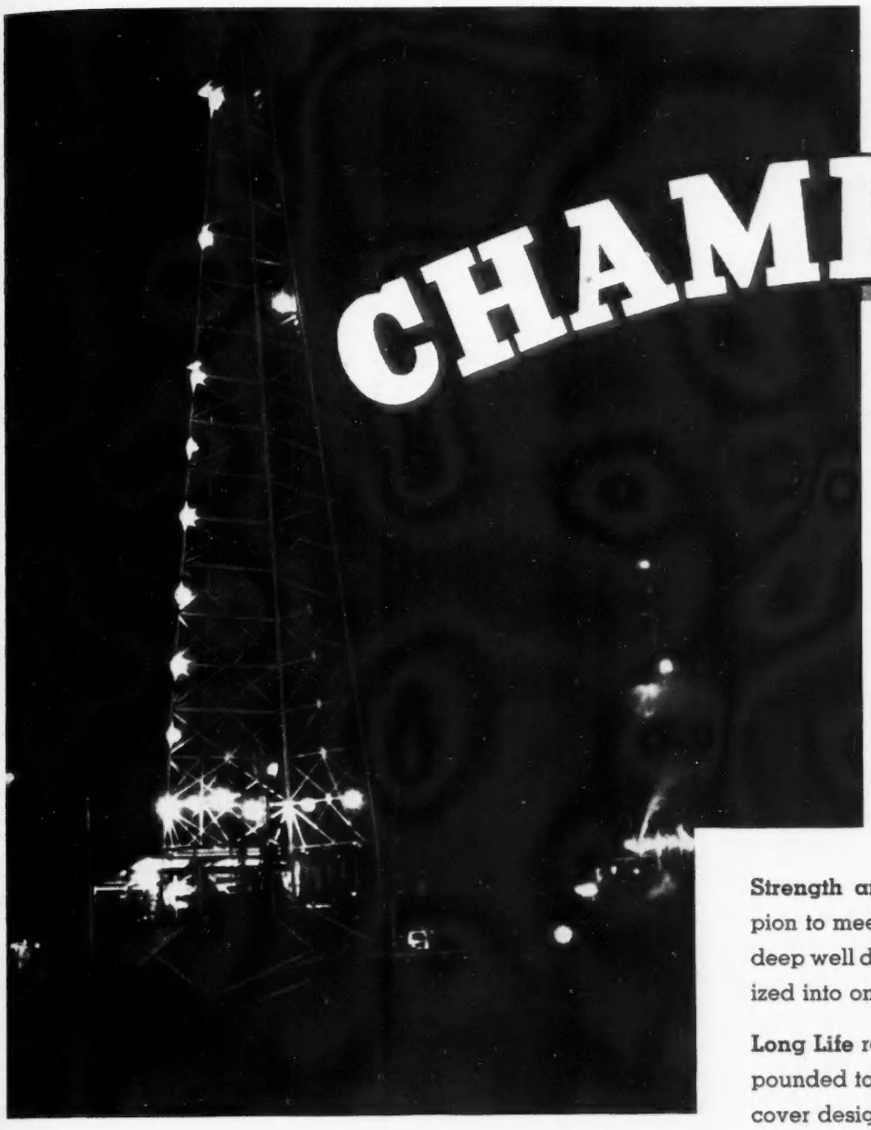

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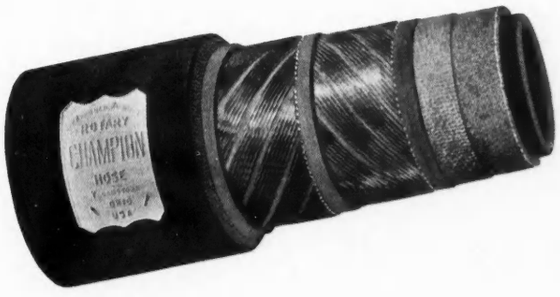

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IMPORTANT WILDCAT TESTS

ALABAMA

CHOCTAW COUNTY—Joe Modisett et al's McCorvey 1, se sw sw 20-9n-2w, setting 16-in surf csg 200 ft.

GREENE COUNTY—Willis & Payne's R. C. Lett 2, se nw 6-21n-2e, dk.

HOUSTON COUNTY — Rice O&G Co.'s Oakley Est. 2, nw sw 9-3n-29e, elev 191 ft, top Tuscaloosa 3060 ft, arr deepen to 6000 ft, td 4975 ft, Tuscaloosa.

MOBILE COUNTY — Grand Bayou O&G Co.'s J. A. Stafford 1, sw sw 24-7s-3w, lcn.

ARKANSAS

ASHLEY COUNTY—Joe Modisett & Phillips Pet. Co.'s Stillions Lbr. Co. 1, c s½ sw nw 18-17-9, mim.

CLARK COUNTY — McLarry & Carlin's Bierne Lbr. Co. 1, ne se ne 22-10s-21w, rur. J. G. Wooten's Sparkman 1, sw nw 1-11-20, sd 545 ft. M. W. Martin's C. L. Cabe 1, nw nw 14-10n-20, spd 10-in csg 80 ft.

CLAY COUNTY—Nelson et al's Underwood 1, se sw ne 4-20-8, sd 800 ft.

GRANT COUNTY—Wallace & Staples' W. F. Davis 2, se se nw 23-6-15, fsg drill stem 2380 ft.

HEMPSTEAD COUNTY—Root Pet. Co.'s Drake 1, se nw 23-14-24, elev 311 ft, base massive anhydrite 2905 ft, dr 4103 ft shale. J. R. Birdwell's Duckett 1, 24-13-24, 10-in csg 100 ft, sd 1530 ft shale. Sheppard & Todd's Smith 1, ne sw se 1-11-25, sd 600 ft.

LA FAYETTE COUNTY—King Drlg. Co.'s Walcott 1, c ne sw 36-19-26, 12½ in csg 488 ft, dr 4186 ft.

LITTLE RIVER COUNTY—J. G. Strahan's Dierks Lbr. Co. 1, 21-12-28, dr 2175 ft, oolitic lime.

MILLER COUNTY — Nivla Oil Corp.'s Merchants & Planters Bank 1, se se 18-15-26, spd and finishing rur. Thad Bryant's Commercial Bank 1, 20-18-28, lcn. W. M. Layton et al's Fee 1 to 10, inclusive, on Rector land, 17-20-28, lcns. Allred & Allred's E. A. Rector 1, w½ w½ 16-20-28, lcn. Tony DeGrazier's E. A. Rector 1, sec 17-20-28, lcn. Kimbrough et al's Capps 1, ne sw 11-20-28, mim.

NEVADA COUNTY — Benedum & Trees Oil Co.'s Block 1, ne se 9-14-20, elev 287 ft, cored sandy lime so 4990-5012 ft, dry and abn, td 5294 ft; Mary Jackson 1, nw ne 9-14-20, tested 900 ft, cemtd csg 2134 ft, wosr 2138 ft; Mary Jackson 2, ne ne 9-14-20, rur. W. S. King's Wren 1, sw ne 6-13-22, sd 2610 ft. Walter Lown's P. B. Grayson 1, sw se 12-14-20, sd 2200 ft. C. B. & F. Pet. Co.'s Haynie 1, 5-14-20, dry abn, td 1202 ft. A. M. Lacey's Bennett 1, sw ne 28-14-22, rur. Axel Larson's J. T. Wortham 1, sw nw 29-13-21, dry abn 2340 ft. W. E. Stewart's Mendenhall 1, nw ne 1-14-20, dr 980 ft. Benedum & Trees Oil Co.'s W. R. Mitchell 1, sw se 4-14-20, rur. G. H. Vaughn's Christopher 1, sw se 3-14-20, dr 2000 ft.

SALINE COUNTY — Duncan & Gibbens' Williams 1, nw ne ne 18-3-15, woc 10-in 104 ft.

UNION COUNTY—Lion O. R. Co.'s Morgan 1, 18-18-17, tested hfo in 2 drill stem tests, hole clean, 7-in csg set, woc, td 5559 ft Permian. Ark. Southern Oil Co.'s G. G. Simmons 1, nw nw 15-18-13, woc 200 ft. Sklar Oil Corp.'s Cordell 1, ne se sw 24-19-16, rur.

ABBREVIATIONS

The following abbreviations, signs, etc., are used in completions and wildcat reports in THE OIL WEEKLY.

*—*dry hole abandoned well.*	owdd—*old well drilling deeper.*
‡—*salt water (completions).*	owpb—*old well plugging back.*
†—*junked and abandoned.*	pb—*plugged back or plugging back.*
¶—*million feet of gas.*	r—*reaming.*
abd—*abandoned.*	rog—*rig on the ground.*
bbls—*barrels.*	rur—*rigging up rotary tools.*
br—*building rig.*	rust—*rigging up standard tools.*
b.s.—*basic sediment.*	sd—*shut down.*
csg—*casing.*	sdtr—*sidetracking.*
co—*cleaning out.*	sg—*show gas.*
dd—*drilling deeper.*	si—*shut in.*
dk—*derrick.*	so—*show oil.*
dr—*drilling.*	so&g—*show oil and gas.*
fsg—*fishing.*	spd—*spudding.*
ft—*feet.*	sr—*straight reaming.*
hfw—*hole full of water.*	sw—*salt water.*
in—*inches.*	td—*total depth.*
lcn—*location.*	ur—*underreaming.*
m—*milling.*	wih—*water in the hole.*
mim—*moving in materials.*	wo—*workover.*
mit—*moving in tools.*	wocs—*waiting on cement to set.*
mot—*milling on tools.*	wosr—*waiting on standard rig.*
n, s, e, w—*north, south, east, west.*	
oih—*oil in hole.*	

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CALIFORNIA

FRESNO COUNTY

CANTUA CREEK—Western Gulf's S. P. Land 3, 3-17-15, td 8531 ft, redr to 8525 ft, swabbing oil and water.

KERN COUNTY

LERDO—Arkelo Pet. Co.'s No. 1, 23-28-26, td 10,056 ft, fsh dr pipe, top 4400 ft.

KERN FRONT — Barnhart-Morrow Cons. Davies 1, 3-28-27, td 2630 ft, plug 2350 ft, to redr. Saskayden Oil Co.'s No. 3-A, 17-28-27, td 2890 ft, plug 2870 ft, sanded up.

ARVIN—Bear Mountain Oil Co.'s Tejon 1, 21-31-30, td 1670 ft, top of granite at 1650 ft, abn; Tejon 2, 16-31-30, skidded rig from No. 1.

GRAPEVINE—Ohio Oil Co.'s Title Ins. D-1, 21-11-19, td 7421 ft, to run formation tester. Reserve O&G Co.'s Tejon 33-2, td 4505 ft, ran new liner, bailing; Tejon 33-3, td 4431 ft, gas well, shut in.

SAN EMIDIO—I. L. Burch's No. 1, 3-10-23, td 2590 ft, rep equip. Union's Kern Co. 1-34, 34-28-25, rur.

CUYAMA—Burkholder Oil Corp.'s Clay 1, 14-10-26, spud Mar. 22, to set 14-in 165 ft.

ROSEDALE—Continental's K.C.L. A-1, 8-27-24, td 9540 ft, co 9303 ft; K.C.L. B-1, 12-29-26, dr shale 5875 ft.

DEVIL'S DEN—Den Pet. Co.'s Bates 1, 20-25-19, dr brown shale 3390 ft. Lube Oil Co.'s No. 1, 2-25-18, swabbing water 4288 ft.

JASMINE—Doyle Pet. Corp.'s Quinn 1, 15-25-27, td 2956 ft, plug 2882 ft, bailing sand; No. 2, dr shale 1707 ft.

ELK HILLS—Elk Hills Pet. Co.'s No. 1, 14-31-28, dr gray sandy shale 5986 ft.

NO. KERN RIVER—Hub Oil Co.'s No. 1, 8-28-28, rur.

RIO BRAVO—Mohawk Pet. Co.'s K.C.L. 1, 23-29-25, dr sand and shale 6210 ft. Tide Water Associated's K.C.L. 2, 30-29-25, sd 9000 ft. Union's Kern Co. 1-34, 34-28-25, rur.

ROUND MOUNTAIN—Pageman & Hennes' Pagehen 1, 10-28-29, rig.

WASCO—Seaboard Oil Corp.'s Continental K.C.L. C-1, 26-27-24, td 5000 ft, to perforate and test.

TEN SECTION—Shell's Canal 21-14, 14-30-25, dr shale 2960 ft. Superior and Union's K.C.L. 8, 11-30-26, td 10,409 ft, wocs 7-in 10,380 ft.

GOSFORD—Signal O&G Co.'s K.C.L. 1-A, 21-30-27, dr sandy shale 7380 ft.

WEST MOUNTAIN VIEW — Sunset Oil Co.'s Sunset-Starr 1, 17-30-28, rur.

McGUNDEN—Superior Oil and A. T. Jergins Trust's Crome Com. 1, 36-29-28, dr shale 3000 ft.

BAKERSFIELD—Wilshire Oil Co.'s Cohn 1, 35-29-27, grading lcn.

HUMBOLDT COUNTY—Texas Co.'s Eureka 2, 22-3-1, td 7418 ft, wocs 8⅝-in at 6580 ft.

KINGS COUNTY—Central Calif. Utilities' Kettleman-Lakeview 3, 11-23-19, td 1196 ft, plug 1190 ft, sd. Dudley Ridge Dev. Co.'s No. 2, 24-23-20, foundation. Pyramid Prod. Co.'s Spreckles 2, 16-24-18, lcn. Kettleman View O&G Co.'s No. 1, 9-22-19, td 4787 ft, wocs 6⅝ in at 3400 ft. T. G. Norell's Guess 1, 7-21-21, sd 6172 ft. Glen C. Stone's Teeter 1, 25-20-20, td 985 ft, wocs 8⅝-in at 790 ft. Tide Water Associated's Avenal 2, 35-23-17, td 2650 ft, in oil sand, ran formation tester, muddy oil.

SAN BENITO COUNTY—Tide Water Associated's Murphy Ranch 1, 5-12-4, dr conglomerate 6815 ft.

SAN JOAQUIN COUNTY—Coast Explor. Co.'s T.F.I. 1, 2-3-4, td 750 ft, wocs 13⅜-in at 405 ft. Standard's McDonald Farms 3, 24-2-4, rig.

SOLANO COUNTY—Amerada's Drouin 1, 25-4-2, dr sand and shale 3140 ft; Mayhood 1, 35-4-2, td 4533 ft, flowing short periods, and shutting to build up pressure.

TULARE COUNTY—R. R. Ellis' Ellis 1, 20-24-23, rig. E. P. Jennings' No. 1, 4-24-23, td 2709 ft, plug 2685 ft, tested wet; No. 2, 33-23-23, rig.

MONTEREY COUNTY—Amil A. Anderson's No. 1, 15-24-14, dr shale 530 ft. Shell's Branch 2, 34-24-10, dr shale 7340 ft.

SAN LUIS OBISPO COUNTY—Barnsdall's K.C.L. A-1, 1-32-20, dr shale 2534 ft. Gretna Corp.'s Miano 1, 25-30-10, rur. Pismo Pet. Co.'s No. 1, 5-32-13, dr shale 3260 ft. Temblor Oil Co.'s No. 1, 22-32-21, rur.

SANTA BARBARA COUNTY — Nine Springs Oil Co.'s Brinkerhoff 1, 9-7-30, dr shale 3290 ft. Todos Santos Oil Co.'s No. 1, 29-9-34, td 2365 ft, co to 2300 ft, bailing. Union's O'Donnell 1, 21-10-34, dr blue shale 1997 ft.

VENTURA COUNTY—Continental's Casitas 1, 7-3-23, fsh 5644 ft. El Rancho Oil Co.'s Elkins 1, 9-3-19, td 5107 ft, plug 4950 ft, pumping oil and water. Merchants Pet. Co.'s No. 7, Sespe Canyon, 1-4-20, dr shale 847 ft. Speik Oil Co.'s Speik 1, 35-5-19, dr shale 2029 ft.

SOUTHERN CALIFORNIA

NEWHALL—Barnsdall's Rancho S.F. 1, 26-4-17, td 6472 ft, ran 425 ft of 4¾-in including 315 ft of perforated, swabbed on Mar. 25, made 380 bbls of 36 gravity oil cut 4 percent, and 800,000 cu ft of gas, still testing. Holbrook Pet. Co.'s Newhall Land 1, 28-4-16, dr hard brown shale 4935 ft.

PICO CANYON—A. G. Burt's No. 1, 36-4-17, td 590 ft, rep. machinery.

ARTESIA—Caltana Corp.'s Montana Land 1, 11-4-12, rur.

NO. LONG BEACH—Geo. L. Clayton's No. 1, 32-3-12, dr sand and shale 3990 ft.

EAST WHITTIER—Drillers Inc.'s No. 1, 22-2-11, td 1640 ft, wocs 8⅝-in 846 ft.

DAVIDSON CITY—Hilldon Oil Co.'s Flood Control 1, 11-4-13, td 5732 ft, pumped 75 bbls, 28.5 gravity clean oil at 5690 ft, to test at 5732 ft.

WEST COYOTE—Hogan Pet. Co.'s McNally 1, 23-3-11, dr shale 1220 ft.

WALNUT—Julian & Criswell's Langstaff 1, 5-2-9, dr shale streaks hard sand 1484 ft.

HERMOSA BEACH—Leora Oil Co.'s No. 1, 31-3-14, dr 5390 ft.

PALOS VERDES HILLS—McClaren Bros.' No. 1, 27-4-14, td 3970 ft, to set 8⅝-in 1805 ft.

ROSECRANS—Shell's McKinley 4-1, 20-3-13, td 7744 ft, had to recement 8⅝-in.

ORANGE COUNTY—Mesa Oil Co.'s Mesa 1, 29-6-10, dr hard brown shale 6233 ft. Shell's No. A-1, 23-3-9, dr 450 ft; Mathis 1, 23-4-10, dr shale streaks of gas sand 4650 to 4680 ft, showing good gas.

FLORIDA

LAKE COUNTY—Oil Dev. Co. of Fla.'s Gulf Expl. Co. 2, se se 17-24s-25e, elev 120 ft, ran electrical tester, arr set csg, td 6118 ft, red quartzite.

NASSAU COUNTY — St. Mary's River Oil Corp.'s Hilliard Turpentine Co. 1, nw nw se 19-4n-24e, elev 110 ft, fsg bit, td 1408 ft lime.

POLK COUNTY — Edw. A. Hill's Polk County Lbr. Co. 1, nw nw ne 32-25s-25e, dk.

KANSAS

BARTON COUNTY—I.T.I.O. Co.'s Schreppel 1, se se ne 26-20s-11w, set 6-in csg 3269 ft; woc. Herndon Drlg. Co. and Morgan & Flynn's Robenseifer 1, cnw 7-8s-15w, dr 777 ft. Stanolind's Burmeister 1, ne ne sw 33-19s-11w, td 3363 ft, D & A. C. L. Price et al's Kraft 1, sw nw ne 10-17s-11w, dr 2590 ft. C. L. Carlock's Leibel 1, se ne se 18-18s-11w, fsg 1860 ft. Missouri Valley O&G Co.'s Peach 1, se se se 24-16s-14w, ru. Ralph Wixon and Union O&R Co.'s Frederick 1, nw nw nw 12-16s-13w, dr 865 ft. S. A. Murphy's Beck 1, ne ne ne 17-17s-12w, lcn. Geo. Dickey et al's Boger 1, se se ne 15-16s-13w, br. C. L. Carlock's Ehly 1, ne ne se 5-18s-11w, rot rig. C. H. Weaver's Stumps 1, ne ne ne 3-17s-12w, mim.

BUTLER COUNTY—A. M. Landon et al's McCaig 1, ne ne se 13-28s-6e, td 2740 ft; 500 ft oih 18 hrs. C. L. Seibel et al's Bisagno 1, se se nw 24-25s-6e, set 6-in csg 600 ft. Vickers Pet. Co.'s Voth 1, cnl s½ sw ne 32-14s-4e, dr 255 ft. Sid Neff et al's Church 1, sw ne se 8-28s-5e (owdd, otd 200 ft); dr 785 ft.

CHASE COUNTY—Hanna et al's Brothers 1, se se nw 25-20s-8w, dr 3313 ft.

CHAUTAUQUA COUNTY — W. M. McKnab's Griffith 1, sw sw sw 11-32s-10e, dr 70 ft. E. I. Shaffer's Nuckalls 1, nw nw nw 12-33s-9e, dr 890 ft. Ira Scott et al's Lambe 1, sw nw ne 18-33s-13e, ru mach.

COWLEY COUNTY — W. M. McKnab's Weldschmidt 1, sw sw nw 19-34s-6e, dr 3275 ft. McKnab's Community 1, cne nw 14-34s-3e, dr 3595 ft. Wentz & Amerada's Rush 1, nw sw sw 36-34s-6e, hfw 2015 ft, ur 10-in csg 2059 ft. Tom Palmer's Lowe 1-A, sw se se 3-32s-5e, dr 1400 ft. Ryan Consolidated's Couch 1, sw sw se 13-30s-5e, dr 920 ft. Elmer Ash et al's Bolack 1, nw nw se 22-32s-6e, cel. Bess & Gralapp et al's Wakefield 1, ne se sw 18-30s-6e, mim.

DECATUR COUNTY—Bruce et al's Newbold 1, cne sw 34-2s-28w, mim.

ELK COUNTY—Wentz et al's Love 1, sw se ne 35-30s-9e, ru.

ELLIS COUNTY—Empire's Samuelson 1, ne ne ne 31-11s-16w, woc. Murphy Oil Co.'s Weisner 1, se se sw 12-14s-19w, testing. Lario O&G Co.'s Cress 1, ne ne ne 13-11s-17w, td 3302½ ft; pot 2362 bbls oil, comp. Empire's Hall 1, se se se 2-12s-17w, flo 4 bbls wtr per hr; ur 5-in csg. Sunray Oil Co.'s Befort 1, ne ne ne 11-14s-20w, sd 3903 ft. Mazda Oil Co.'s Henderson 1, sw sw ne 27-11s-18w, spd. Noble Pet. Corp.'s O'Laughlin 1, nw nw se 13-12s-19w, dr 1535 ft. Earl Wakefield's Putnam Mort. Co. 1, se se nw 32-15s-17w, dr 860 ft. Ted Kors et al's Koblitz 1, se sw nw 23-12s-18w, testing. Bridgeport Mach. et al's Froelick 1, nw nw se 4-13s-16w, set 15-in csg 485 ft; lr 600 ft.

ELLSWORTH COUNTY — Frost et al's Dolechek 1, ne ne sw 36-14s-8w, dr 1870 ft. Orville Lee's Larkin 1, nw nw nw 15-16s-8w, br.

FINNEY COUNTY—Keith & Olson Drlg. Co.'s Ely 1, nw nw sw 34-22s-29w, dr 4795 ft.

GRANT COUNTY—Columbian Fuel Co.'s Gray 1, cse 3-29s-35w, td 2760 ft; 5,000,000 cf gas; comp.

GREENWOOD COUNTY—Ohio Oil Co.'s Schwab 1, se sw se 9-24s-10e, P 1 bbl oil, ½% wtr. Lauck & Moncrief's Gruber 1, nw nw nw 5-23s-13e, set 8-in csg, 1497 ft. Shull Drlg. Co.'s Cannon 1, ne se ne 23-25s-12e, rum. Dr. Shippey's Boone 1, ne ne nw 21-26s-2e (owdd, otd 1130 ft); dr 1637 ft.

HARPER COUNTY—Carter Oil Co. et al's Seihart Estate 1, csw nw 4-34s-8w, dr 4035 ft.

HARVEY COUNTY—Harburney Oil Co.'s Schragg 1, nw nw se 24-22s-3w, fsg 3711 ft. E. I. Shaffer et al's Epp 1, se se sw 15-23s-3w, lcn.

KEARNEY COUNTY — J. L. Murphy's Masonic Home 1, cnw¼ 1-25s-36w, mi rot tools.

LOGAN COUNTY—Rosespring Drlg. Co.

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ROSELLE, NEW JERSEY

et al's Wright 1, cse se 12-15s-35w, dr 3940 ft.

LYON COUNTY—Clyde Fred et al's Bruce 1, nw nw nw 13-18s-10e, woc. Davis & Sory's Byrd 1, sw sw se 32-21s-11e, rum.

McPHERSON COUNTY—Hutchinson O&G Co. et al's Berg 1, sw sw se 15-20s-3w, set 10-in csg 2430 ft; dr 2620 ft. Wamhoff et al's Nuse 1, se se sw 18-18s-4w, surf hole. Bradley Bros.' Barnholt 1, sw sw se 30-20s-5w, dr 175 ft. Fred C. Frank et al's Coles 1, se nw ne 12-19s-1w, sd 550 ft.

MITCHELL COUNTY—Geo. Seidhoff et al's Greiss 1, sw sw se 16-8s-10w, set 8-in 2149 ft; co 2288 ft.

NESS COUNTY—Newton Dev. Co.'s Tenny 1, nw nw se 19-18s-25w, dr 4005 ft. Jones & Lane's Page Milling Co. 1, se se nw 36-18s-26w, rig.

RENO COUNTY—Clyde Pulse et al's Payne 1, sw nw ne 4-22s-7w, pb 3244 ft; 500 ft oih. Foraker et al's Hiett 1, se sw ne 34-24s-4w, dr 3960 ft. Atlantic's Page 1, se nw nw 19-23s-7w, fsg 3681 ft. Olson Drlg. Co. et al's Herriman 1, nw nw nw 22-24s-8w, rot rig. Imo O&G Co. et al's Watkins 1, se se se 14-22s-7w, spd. Westgate-Greenland Oil Co.'s O'Sullivan 1, sw sw ne 24-23s-5w, dr 3300 ft. Sinclair Prairie's Nett 1, nw nw se 32-26s-4w, lcn. Earl Wakefield's Yoder 1, sw sw sw 34-24s-5w, td 3463 ft, D & A. Helmerich & Payne et al's Evans 1, ne ne se 29-24s-6w, lcn abd.

RICE COUNTY—Continental et al's Michells 1, ne ne sw 12-18s-2w, rust. T. C. Johnson's Schubert 1, sw sw sw 9-20s-10w, ur 8-in csg 2365 ft. L. E. Douglas' Coyne 1, ne se se 24-21s-8w, dr 1725 ft. John Hanna et al's Fulton 1, nw nw ne 24-19s-6w, dr 2205 ft. Manning, Martin et al's Mathes 1, se sw ne 27-21s-8w, sd 3685 ft. Roy Ramsey et al's Malone 1, nw nw ne 1-20s-10w, dr 2985 ft. C. E. Skiles et al's Helmer 1, nw nw ne 7-19s-8w, mim. Skelly Oil Co. and Ewers Simpson Oil Co.'s Linville 1, sw nw ne 2-20s-10w, dr 1375 ft. Fred Phillips et al's Hubenett 1, sw ne sw 23-20s-6w, spd. Bradley Oil et al's Ginter Heirs 1, nw nw nw 13-20s-8w, lcn. W. E. Witt et al's Fair 1, ne se se 4-22s-8w, set 15-in csg 139 ft; dr 200 ft.

ROOKS COUNTY—Snowden & McSweeney's Hindman 1, ce½ nw 35-7s-17w, swb 25 bbls oil and 100 bbls wtr, 24 hrs. Lester & Dean's Burtt 1, se se ne 29-10s-20w, fsg 3422 ft. Phillips Pet. Co.'s Manquist 1, sw sw nw 9-9s-17w, dr 440 ft. Jones Bros. Drlg Co.'s Wiss 1, nw nw nw 8-10s-8w, dr 1275 ft. Basin Oil Co.'s Baxa 1, ne ne ne 23-9s-17w, dr 2460 ft. Buckner & Schoff's McConnell 1, ne ne ne 34-6s-18w, sd 3100 ft. Twin Drlg. Co.'s Doughty 1, sw sw sw 15-8s-19w (owdd, otd 3225 ft); dr 3248 ft.

RUSH COUNTY—S. A. Murphy et al's Roth 1, nw nw sw 21-16s-18w, dr 1176 ft.

RUSSELL COUNTY—S. A. Murphy et al's Deines 1, se se sw 36-15s-15w, ru. Goldstein & Vernon O&G Co.'s Steinert Estate 1, ne se sw 34-15s-15w, mim.

SCOTT COUNTY—Patton & Paul's Lank 1, se se sw 35-18s-31w, lcn.

SEDGWICK COUNTY—Cameron et al's Smith 1, sw se se 13-27s-2e, fsg 2782 ft. Swearer et al's Thome 1, sw sw nw 19-28s-1w, cor. Roxanna Drlg. Co. et al's Woodman 1, sw nw sw 26-26s-1w, dr 1300 ft. Empire O&R Co.'s Kimel 1, nw nw nw 4-29s-2w, set 15-in csg 102 ft; dr 1000 ft. E. B. Shawver's Furman 1, sw ne se 24-29s-3w, ru.

STAFFORD COUNTY—Empire's Jordan 1, sw sw nw 15-25s-14w, cor. Empire's O'Conner 1, ne ne ne 17-24s-15w, woc. Young et al's Murphy 1-A, se nw ne 32-21s-11w, fsg 1380 ft. Trigg & Vernon O&G Co.'s Andrea 1, se se se 4-23s-12w, dr 3150 ft. Rosespring Drlg. Co.'s Gray 1, nw nw nw 11-24s-13w, mi r g. W. P. Faulkner's Schulz 1, se se ne 6-22s-13w, rot rig.

SUMNER COUNTY — Westfall et al's Rogers 1, sw ne sw 35-31s-1w, td 4406 ft, D & A. Graham et al's Dawson 1, nw nw nw 4-33s-2w, fsg 4008 ft. E. B. Shawver et al's Bryan 1, cw½ w½ sw 36-30s-2w, dr 2022 ft. The Texas Co.'s Harper 1, ne sw se 9-30s-3w, fsg 1006 ft.

TREGO COUNTY—Black Gold Oil Co.'s Allman 1, csw sw 34-14s-21w, cor 3912-23 ft; no show.

WOODSON COUNTY — Harper et al's Weidie 1, se se ne 10-24s-14e, dr 2013 ft.

NORTH LOUISIANA

BIENVILLE PARISH—Lide, Greer et al's J. D. Smelley 1, sw ne 13-16n-5w, elev 239 ft, base massive anhydrite 5640 ft, 7-in csg 7368 ft, completed as gasser with dist si for gauge, td 7393 ft; W. J. Smelley 1, se nw sw 18-16n-5w, mim. McDowell et al's Locke 1, 9-15n-10w, claim sg, arr make ds test 2564 ft shale. DeSoto O&G Co.'s Wm. Ashley 1, sw se 15-16n-10w, mim. Seaboard Oil Corp.'s McGee 1, 3-16n-6w, 7-in csg 7537 ft, perf csg 6665-95 ft, est 67 mil ft gas daily, si for gauge, td 8017 ft.

BOSSIER PARISH—Ark. La. Gas Co.'s Wilson 1, sw se sw 8-17n-11w, dr 3991 ft. Haynes Drlg. Co.'s A. J. Murff 1, 35-17n-12w, dr 5510 ft shale. La. Pet. Corp.'s Edwards 1, 5-17n-11w, si for gauge, td 5184 ft. Producer O&G Co.'s Johnson 1, 5-17n-11w, lcn. Triangle Drlg. Co.'s Skannal I-1, 22-17n-12w, si for gauge 5170 ft. H. L. Skannal H-1, sw sw 23-17n-12w, testing with so, td 5166 ft. United's Skannal I-1, sw sw 25-17n-12w, dr 4616 ft; Henderson-1, 36-17n-12w, coring 5430 ft; Webb Unit 1, 23-17n-12w, dr 3784 ft.

CADDO PARISH—Fallon Oil Co.'s Cupples 1, 24-16n-13w, 10⅝ in csg 2000 ft, massive anhydrite 4323-4508 ft, coring 5075 ft. Gulf's E. P. Hatcher 1, 11-17n-15w, elev 269 ft, 7-in csg 8307 ft, dr 9187 ft. W. J. Hunter's N. B. Stoer 1, sw ne 10-15n-15w, spd, woc 90 ft. R. W. Norton's Payne 1, se se 27-23n-16w, coring 8828 ft. Prairie River Synd.'s Hutchinson 1, 15-15n-12w, owdd, td 7378 ft.

CLAIBORNE PARISH—Lisbon Oil Co.'s J. W. Burgess 1, se ne 3-20n-5w, elev 354 ft, base massive anhydrite 4212 ft, top Travis Peak 5406 ft, oil stains in core 5444 to 5463 ft, ran electrical tester. Lyons & Neely's Patton 1, nw sw 36-21n-5w, completed at 5292 ft, flowing 33 bbls oil per hour through 1-inch choke. Lyons & Neely's Maggie Patton 1, nw sw 31-21n-4w, mim. T. L. James & Co.'s H. W. Patton 1 and 2, ne se 36-21n-5w, lcns. J. R. Bevill et al's Edmonds 1, 16-20n-5w, mim. Red Iron Drlg. Co.'s H. F. Patton 1, sw ne 36-21n-5w, completed at 5312 ft, flowing estimated 1200 bbls oil daily. H. F. Patton 2, 36-21n-5w, lcn. T. E. Patton 1, 36-21n-5w, lcn. McDonald 1, 36-21n-5w, lcn. Gulf's H. F. Patton 1 and 2, nw sw 36-21n-5w, spd; Maggie Patton 1, sw sw 31-21n-4w, rur. Standard of La.'s R. D. Baker 1, nw nw 27-19n-7w, top red beds 3760 ft, dr 5537 ft, top massive anhydrite 5155 ft. United's Warren Brown 1, se ne 1-19n-6w, 5⅜ in csg 5719 ft, si after flowing oil, td 5984 ft; Rufus Simms 1, sw nw 32-20n-5w, si for gauge, td 5714 ft. Love Pet. Co.'s H. E. Patton 1 and 2, sw se 36-21n-5w, lcns. McMillan & DeArmand's Maggie Patton 1, ne sw 31-21n-4w, lcn.

CATAHOULA PARISH — Balconies Oil Co.'s T. J. Chisum 1, 19-10n-8e, rur. Matheny & Schumacher's W. S. Peck 1, 40-10n-8e, mim.

DE SOTO PARISH—Sundby et al's Garland 1, se nw 7-14n-14w, elev 300 ft, top anhydrite stringer 4228 ft, dr 5469 ft, oolitic lime. Stevens et al's Leslie Golden 1, se sw 2-11n-16w, lcn. Benedum & Trees Oil Co.'s Clifton 1, ne nw 33-13n-12w, 12¾ in csg 1010 ft, drilling 4408 ft lime and shale. Julian-Igoe Synd.'s H. Smith 1, se se 31-14n-15w, lcn. Sanders et al's Allison 1, 17-14n-13w, mim. Chamberlin et al's Lanier 1, 29-11n-11w, dk. Grady Vaughn et al's Sample 1, ne se 24-11n-14w, owdd, 5955 ft. Pearl Oil Corp.'s Joyner 1, 28-11n-12w, 8¼ in csg 2885 ft, dry at 2899 ft, fsg 3000 ft. L. S. Fite-Grogan Oil Co.'s Ramsey 1, 36-11n-11w, ow, abn at 3027 ft, began to flow oil, arr set csg and test, td 3027 ft.

RAPIDES PARISH—R. D. Webb's Brasher 1, 22-4n-2w, dr 4150 ft.

RICHLAND PARISH—Gulf's R. R. Rhymes 15, se se 32-17n-6e, elev 87 ft, dr 9940 ft.

WINN PARISH—C. W. Cline's Collingsworth Hrs. 1, se se 14-10n-4w, dk and mir.

FRANKLIN PARISH—Jensen et al's Grayson 1, c ne 36-12n-6e, rur (formerly carried Bailey 2).

GRANT PARISH—Horace M. Smith Corp.'s & McConnell Oil Co.'s Ivy McNeely 1, swc 16-6n-3w, spd. H. Weir's Quin 1, 10-7n-3w, spd and finishing rur. Tri-State Leasing & Dev. Co.'s Edenborn 1, ne se se 13-7n-4w, ran electrical tester, td 3000 ft.

SOUTH LOUISIANA

ACADIA PARISH—H. E. Dalton's Setting 1, Trilby prospect, 17-9s-1w, fsh 5426 ft. Humble's Nordyke 1, Ebenzer prospect, 23-10s-1e, dr shale 9689 ft.

CALCASIEU PARISH—D. & D. Oil Co.'s Lutcher Moore 1, nw of Starks, 1-8s-13w, fsh 8398 ft.

CAMERON PARISH — Magnolia's Albert

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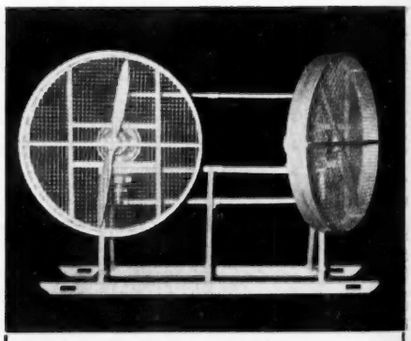

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ABBREVIATIONS

The following abbreviations, signs, etc., are used in completions and wildcat reports in THE OIL WEEKLY.

*—*dry hole abandoned well.*
‡—*salt water (completions).*
†—*junked and abandoned.*
¶—*million feet of gas.*
abd—*abandoned.*
bbls—*barrels.*
br—*building rig.*
b.s.—*basic sediment.*
csg—*casing.*
co—*cleaning out.*
dd—*drilling deeper.*
dk—*derrick.*
dr—*drilling.*
fsg—*fishing.*
ft—*feet.*
hfw—*hole full of water.*
in—*inches.*
lcn—*location.*
m—*milling.*
mim—*moving in materials.*
mit—*moving in tools.*
mot—*milling on tools.*
n, s, e, w—*north, south, east, west.*
oih—*oil in hole.*
owdd—*old well drilling deeper.*
owpb—*old well plugging back.*
pb—*plugged back or plugging back.*
r—*reaming.*
rog—*rig on the ground.*
rur—*rigging up rotary tools.*
rust—*rigging up standard tools.*
sd—*shut down.*
sdtr—*sidetracking.*
sg—*show gas.*
si—*shut in.*
so—*show oil.*
so&g—*show oil and gas.*
spd—*spudding.*
sr—*straight reaming.*
sw—*salt water.*
td—*total depth.*
ur—*underreaming.*
wih—*water in the hole.*
wo—*workover.*
wocs—*waiting on cement to set.*
wosr—*waiting on standard rig.*

Dobbertine 1, Johnson Bayou prospect, 9-15s-14w, dr hard sand 2808 ft. Union Sulphur's Hebert 1, Big Lake area, 18-12s-8w, dr shale and lime 6978 ft. Southern Oil Co.'s State Maritime 2, 15s-10w, dr shale 2359 ft.

EVANGELINE PARISH — Bel Cheney Spring's Fee 1, 10-2s-1w, waiting on dk material, 2214 ft. Continental-Humble's Pardee 1, Reddell prospect, 18-4s-1w, dr shale 6678 ft.

IBERIA PARISH—Jefferson Lake Oil Co.'s Lake Peigneur 414, Jefferson Island dome, 12s-5e,rocking with gas 6495 ft.

JEFFERSON DAVIS PARISH—Amerada-Stanolind's Calcasieu National Bank 1-B, China prospect, 28-7s-3w, abn 9139 ft. Louisiana Crusaders Oil Co.'s I. Langley 1, Fenton area, 36-7s-5w, mim. Shell's Sturdevant , South Roanoke prospect, 25-10s-4w, testing 8590 ft. Stanolind's United Life Insurance 1, Hayes prospect, 16-11s-5w, dr shale 7701 ft.

LAFOURCHE PARISH — Fohs Oil Co.'s State Long Lake 1, Bourge area, 65-17s-19e, dr shale 4819 ft. William Helis' City of New Orleans 1, Marchland prospect, 19-23s-23e, dr sand and shale 7073 ft.

PLAQUEMINES PARISH — Gulf's State Bay Adams "PP", in Bay Adams, 32-19s-28e, dr shale 4079 ft.

ST. BERNARD PARISH—Gulf's Lake Lery 1, Lake Lery prospect, 28-14s-14e, dr shale 5653 ft. Southern Sulphur's State 2, Lake Borgne area, 38-14s-15e, dr shale 2730 ft.

ST. CHARLES PARISH—Amerada-Louisiana Land's State Bayou Des Allemands 1, Black Prince Island prospect, 13-15s-20e, mim.

ST. LANDRY PARISH—Shell's Boagni 1, ne of Cankton field, Bristol area, 48-8s-4e, dr sandy shale 6102 ft.

ST. MARTIN PARISH—Stanolind's Patin 1, Anse LaButte area, 46-9s-5e(abn 6147 ft. Texas Co.'s State 3, Lake Mongouloi prospect, 14-10s-9e, dr shale 5334 ft; same operator's St Martin Land Co. 9, Henderson prospect, 21-8s-7e, dr salt 8858 ft.

ST. MARY PARISH — Texas Co.'s State Bateman Bay 1, Morgan City prospect, 21-16s-12e, dr shale 7464 ft; same operator's State Horseshoe Bayou 1, Wax Lake area, 40-17s-9e, fsh 10,975 ft.

TERREBONNE PARISH—Humble's Ellender 1, Houma Gas field, 23-19s-19e, dr shale 11,227 ft.

MISSISSIPPI

AMITE COUNTY—Jno. P. Wemple, Tr.'s Southern Forest Land Co. 1, sw sw 29-4n-2e, dr 4196 ft sandy shale.

HARRISON COUNTY—Big Ridge Oil Co.'s Hingin 1, se se 13-7s-10w, rur to deepen, td 2150 ft.

HINDS COUNTY — State of Mississippi's Fee 2, nw nw 25-6n-1e, elev 326.5 ft, arr abn at 5500 ft (contract depth).

JONES COUNTY—Snow-Black Pet. Co.'s Cranford 1, s½ nw 29-7n-12w, dr 1990 ft.

LAMAR COUNTY—Sun Oil Co. et al's Mrs. K. Talley 1, se sw 28-4n-15w, dry abn in salt dome cap, td 2015 ft; Mrs. K. Talley 2, nwc ne nw 33-4n-15w, rur.

MONTANA

JUDITH BASIN COUNTY—Fletcher P. Hunt's Hobson 3, nw se ne 3-14n-15e, dr 1340 ft.

PETROLEUM COUNTY—O. B. Canfield's Government 1, cel se ne 21-17n-24e, dr 776 ft. H. Clark Rowland et al's Kalispell 1, ne ne se 31-14n-25e, dr 781 ft.

PONDERA COUNTY—Gordon Campbell et al's Hughes 1, ne ne nw 12-30n-4w, fsg 2497 ft.

NEBRASKA

DAWES COUNTY — Stephens Petroleum Corporation's S. J. Palmer 1, nw sw 10-35n-50w, dr 1855 ft.

LINCOLN COUNTY—Smith & Wright's Hansen 1, csw nw 24-15n-31w, dr 1200 ft, slight so.

SIOUX COUNTY—J. M. Huber Corporation's Morgan 1, csw sw 32-35n-56w, dr 2700 ft.

NEW MEXICO

LEA COUNTY—Anderson-Prichard Oil Corp.'s E. J. Wells-Conoco 1, c se se 5-25s-37e, dr 280 ft. Jim W. Brown & Reynolds' Parcell-Conoco 1, c nw se 8-21s-36e, elev 3573 ft, top anhydrite 1616 ft, base salt 2820 ft, cem 5½-in pipe 4200 ft, used 3000 gals acid 4378 ft, swabbed little oil with water, dr lime 4390 ft. Amon G. Carter et al's E. M. Elliott 2, c ne nw 22-22s-37e, elev 3375 ft, sd 3622 ft. J. C. Clower et al's W. H. Turner 2, sw sw se 29-21s-37e, elev 3464 ft, show gas, dr 3505 ft. Continental Oil Co. et al's Danciger Permit 1, c nw ne 8-23s-36e, elev 3487 ft, lime pay 3732-3790 ft, complete, flowed 43 bbls 34 gravity oil per hr via ¾-in choke natural; J. M. Skaggs 1, c ne se 24-20s-37e, elev 3555 ft, pay 3791-3889 ft, td 3900 ft, used acid twice, complete flowed 21 bbls 33 gravity oil per hr ¾-in choke. Culbertson, Erwin & Stovall's J. R. Stuart-Repollo 3, ne se sw 10-25s-37e, elev 3111 ft, dr 1100 ft. A. R. Eppenauer et al's F. B. Stuart-Amerada 1, ne nw ne 22-25s-37e, elev 3082 ft, top anhydrite 1000 ft, top salt 1200 ft, top pay 3315 ft and flowed 525 bbls 42.6 gravity oil 24 hrs before struck water at 3406-10 ft, pb to 3400 ft, testing. J. E. Farrell & Co.'s E. W. Walden-Amerada 1-A, c sw nw 15-22s-37e, elev 3407 ft, rust, td 3551 ft; Walden 2-B, c ne sw 15-22s-37e, rig; Walden-Amerada 1-C, c sw sw 15-22s-37e, elev 3385 ft, td 3686 ft, shot 280 qts 3540-3680 ft, testing; Walden-Amerada 2-C, c se sw 15-22s-37e, machine. Gulf Oil Corp.'s

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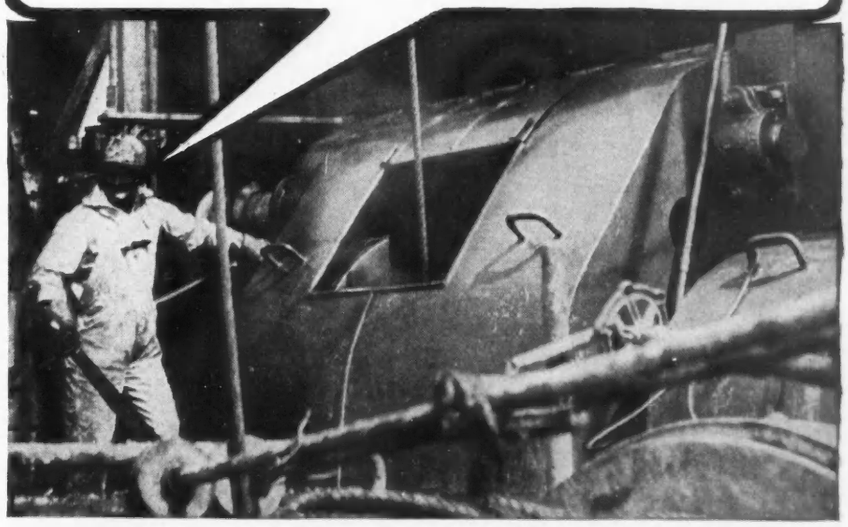

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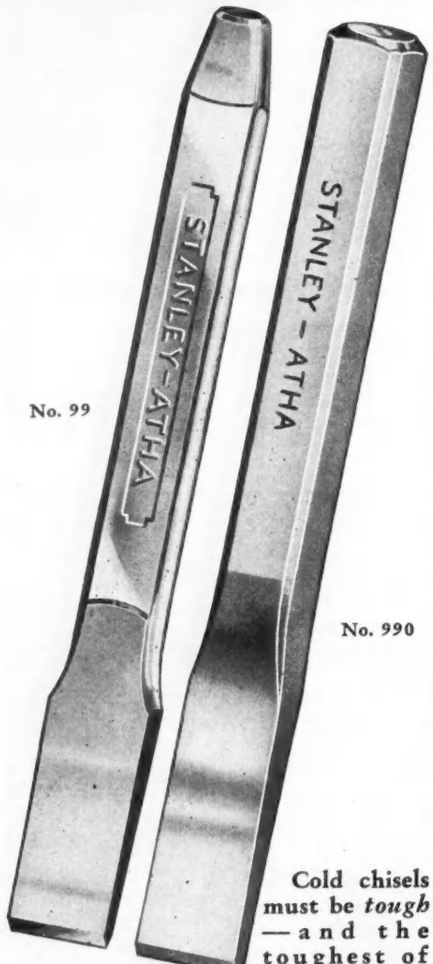

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ROOSEVELT COUNTY—Clovis Dev. Co.'s S. Smith 1, c se ne 17-2s-30e, elev 4597 ft. trace gas 2801-09 ft, dr 2865 ft. Dummitt Oil Co.'s Wm. Todd 1, se se se 34-3n-29e, lcn.

OKLAHOMA

BECKHAM COUNTY — Carter Oil Co.'s Garrett 1, ne ne ne 11-17n-25w, dr 2069 ft. Mid-American Oil Co.'s Biscoe 1-A, sw sw sw 28-8n-22w, td 920 ft; sd.

CADDO COUNTY—Clyde Becker et al's Pharris 1, cse se nw 24-6n-12w, rur.

CARTER COUNTY—Helmerich & Payne's Wolverton 1, se ne nw 21-3s-1w, lcn abd.

CHOCTAW COUNTY—Cooper & Branstetter's Bell 1, cnw ne 29-6s-17e, td 1151 ft, D & A.

CLEVELAND COUNTY—Hollenback's Stinson 1, nw nw ne 17-9n-2w, dr 2555 ft.

COAL COUNTY—Ruwaldt & Couch's McMillan 1, sw sw sw 10-1s-8e, td 1414 ft, D & A.

COMANCHE COUNTY — C. V. Morris' Young 1, se ne se 23-4n-10w, sd 822 ft.

COTTON COUNTY—E. B. Hane's Duper 1, nw nw nw 21-2n-13w, td 250 ft; sd.

CREEK COUNTY—J. E. Crosbie & Sinclair Prairie's Bailey 1, ne nw nw 28-16n-8e, dr 3625 ft. W. J. Sherry's Childers 1, sw sw ne 2-15n-7e, dr 2465 ft. M. W. Mosier et al's Holcomb 1, se sw ne 19-18n-8e, fsg 2935 ft.

GARFIELD COUNTY — Arab Oil Co.'s Harkendorf 1, ne ne ne 34-20n-3w, dr 4200 ft. Ohio Oil Co.'s State 1, sw sw sw 13-23n-2w, br.

GRADY COUNTY—Western White Lily Oil Co.'s Stover 1, cse sw nw 33-3n-7w, fsg 1770 ft.

HASKELL COUNTY—Continental Oil Co.'s Anderson 1, sw se ne 33-8n-20e, mit.

HUGHES COUNTY — Carson Oil Co.'s Lyter 1, ne nw sw 31-8n-12e, td 4940½ ft; testing. Wrightsman's Diamond 1-A, se ne ne se 33-9n-9e, td 3390 ft; 12,000,000 cf gas; trace sw.

JEFFERSON COUNTY—Buffalo Oil Co.'s Crown-Over 1, cse se nw 21-6s-6w, dr 2160 ft. Olson, Heenan & Coe Oil Co.'s Rose 1, csw sw 1-5s-5w, wo tools. Cap Fields et al's Trout 1, ne ne sw 5-8s-7w, dr 2194 ft. Gulf Oil Corp.'s Woodworth 1, cnw nw ne 20-3s-4w, c & p.

JOHNSTON COUNTY—Patton et al's McCrummens 1, sw sw ne 16-1s-6e, sd 1155 ft.

KAY COUNTY—G. A. Brown et al's Harris 1-A, sw sw ne 14-25n-1e, set 20-in csg 59 ft; dr 383 ft.

KIOWA COUNTY — Kiowa Oil Corp.'s Finder 1, csw ne 4-6n-20w, mach on lcn.

LATIMER COUNTY—Clark Drlg Co. et al's Wilson 1, cse se 15-5n-18e, sd 3760 ft.

LINCOLN COUNTY — Anderson-Prichard's Colon 1, nw se sw 28-17n-4e, td 4392 ft; sho wtr; pb 4382 ft; woc. Mid-Continent Pet. Corp.'s Logan 1-A, ne ne se 31-11n-5e, dr 3600 ft.

LOGAN COUNTY — Harry Blackstock's Prince 1, se ne sw 11-17n-3w, dr 6431 ft. Helmerich & Payne et al's Ruck 1, cne se 9-19n-2w, dr 3790 ft. Anthony & Marshall's Fruin-Eckman 1, se se sw 4-16n-1e, swb wtr at 4975 ft.

LOVE COUNTY—Sinclair Prairie's Stockton 1, se se sw 26-6s-2w, run 3-in dp to fish, 5288 ft. Sadson-Wells-Pierson's Koy 1, cse se nw 6-8s-1w, dr 2904 ft.

MARSHALL COUNTY—Stewart & Taylor's Chestnut 1, ne ne ne 23-8s-5e, set 5-3/16-in csg 777 ft; woc.

MURRAY COUNTY—Russell's Fee 1, se nw se 9-2s-3e, dr 1376 ft. Power Oil Co. et al's Lancaster Trust Co. 1, csw ne 10-1s-2e, sd; woc.

NOBLE COUNTY—Lincoln Oil Co. et al's Neil 1-A, ne ne ne 15-23n-2w, dr 2207 ft.

OKFUSKEE COUNTY—Mid-Continent Pet. Corp.'s Gofford 1, ne ne nw 35-12n-7e, spd.

OSAGE COUNTY—Norbla Oil Co.'s No. 1, ne ne se 13-23n-6e, fsg 760 ft.

PAWNEE COUNTY — Forest Dev. Co.'s Markham 1, sw ne se 10-21n-5e, set 7-in csg 3128 ft; rust.

PAYNE COUNTY—H. F. Young's Jenkins 1, se ne se 4-17n-3e, dr 4595 ft. Riddle's Van Zandt 1, nw nw se 16-18n-3e, c & p.

PITTSBURG COUNTY—Okla Dist Co.'s Beeler 1, ne ne sw 7-7n-14e, sd 5165 ft.

PONTOTOC COUNTY — E. H. Moore's Muse 1, sw ne se 33-2n-7e, pb. Caloma Oil Corp.'s Brentz 1, se ne sw 4-1n-6e, td 503 ft, D & A.

POTTAWATOMIE COUNTY — Champlin Ref. Co.'s Buckler 1, se ne ne 7-6n-4e, dr 3795 ft.

PUSHMATAHA COUNTY—Erle Halliburton et al's Bogwell 1, sw ne ne 30-3s-15e, dr 1293 ft.

SEMINOLE COUNTY—Hudson et al's Tanyan 1, se se sw 32-10n-7e, core dry; dr ahead 3615 ft. Sinclair Prairie's Rossanna 1, nw nw sw 28-10n-8e, dr 3805 ft. Amerada & Stanolind's Face 1-A, sw sw sw 12-9n-7e, td 3403 ft; swab ½ bbl oil & 5 bailers wtr per hr. J. E. Hall et al's White 1, se nw se 30-6n-8e, to pb.

STEPHENS COUNTY—Edwards' Frederick 1, ne se nw 31-2n-8w, td 2754 ft; mo rot; to inst mach. Carter's Harley 1, cne ne 24-2s-4w, dr 2967 ft. Wm. Angle et al's Posey 1, cnw nw 8-1n-8w, to cor. Helmerich & Payne's Graham 1, csw sw ne 12-1n-5w, testing 5014 ft. Ed Parson's Olson 1, csw sw 21-2n-8w, td 7002 ft; to test. B. F. Lundy's Calmes 1, cnw sw se 35-1n-4w, dr 2420 ft. Penn State Oil Co.'s Cole 1, cw½ sw nw 21-2n-8w, ru rot mach.

TEXAS COUNTY—Cabot Carbon Co.'s Castro 1, cne 19-3n-17ecm, set 7-in csg 2570 ft. Missouri Valley Gas Corp.'s Fitzgerald 1, c sec 17-6n-14ecm, rig.

TILLMAN COUNTY—I.T.I.O. Co.'s Hatler 1, csw ne 32-2s-17w, testing. D. S. Smith's Hammill 1-A, ne nw nw 6-5s-15w, fsg 2425 ft.

WASHITA COUNTY — John Koberg's Harms 1, cnw nw ne 6-10n-16w, der.

EAST TEXAS BORDER COUNTIES

CASS COUNTY—Cross Roads Oil Corp.'s S. A. Orr 1, G. A. Morris sur, elev 399 ft, sd 200 ft. McAlester Fuel Co.'s J. J. Dooley 1, Calloway Davis sur, mim. United Prod. Corp.'s J. W. Land 1, Robert Potter sur, dr 6699 ft.

HARRISON COUNTY—H. H. Alvord's M. A. Flannagan 1, L. Womack sur, top chalk 1308 ft, wosr, td 2449 ft. C. M. Bagley's J. N. Trosper 2, C. Davenport sur, wosr, 2453 ft. Eastern Shrevetex Oil Corp.'s Mable George 1, J. S. Powell sur, sd 825 ft, shale. Geyer Oil Co.'s Alex Moore 1, C. W. Field sur, pumping 17 bbls oil daily, td 2452 ft. Vincent B-2, G. P. Harrison sur, sd 2140 ft. Kennedy & Batchelor's Lane & Greer 1, J. M. Baker sur, swabbed considerable oil, arr re-acidize, td 2364 ft. Patsan Oil Co.'s Zion Douglas 2, S. Fields sur, top Tokio 2455 ft, 5-in csg 2454 ft, acidized, swabbing oil, td 2512 ft.

MARION COUNTY — Ark-La. Gas Co.'s W. S. Ford 1, Chas. Grayson sur, elev 332 ft, flowed 60 bbls in 12 hours through 1-in choke, re-perf csg, still testing, td 6351 ft. Laura McIntosh 1, Wm. Edmondson sur, elev 272

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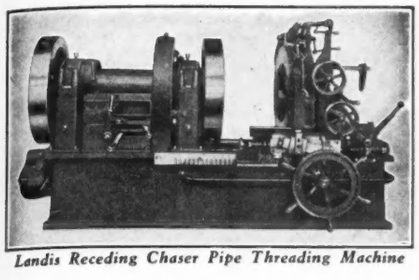

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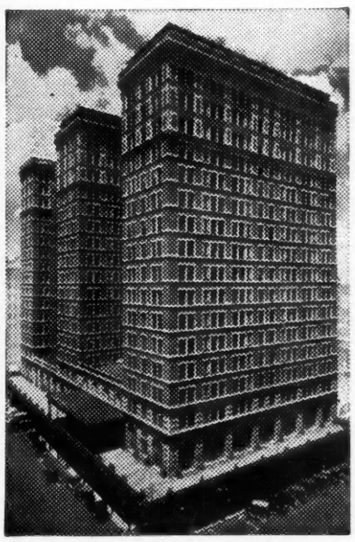

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ft, top anhydrite stringer 5176 ft, massive anhydrite 5444-5706 ft, top Hill 5836 ft, top Gloyd 5933 ft, arr set 7-in csg at 5952 ft, td 6010 ft. Dunn & Fisher's Susie A. Chatten 1, A. de los Santos Coy sur, elev 247 ft, massive anhydrite 5417-5672 ft, top Hill 5800 ft, top Gloyd 5914 ft, dr plug in 7-in csg testing, td 5955 ft, 19 ft sat formation. The Hunter Co.'s Fonda 1, A. de los Santos Coy sur, mim. Holcomb, Thomasson et al's Lizzie Henderson 1, R. Bennington sur, flowing est 10 bbls oil per hour through 2 1/16 in side chokes, td 5996 ft, old td 6405 ft; Lizzie Henderson 2, R. Bennington sur, mir. Ohio Oil Co.'s D. W. Davis 1, 2 and 3, Wm. R. Meyers sur, lcns. Mrs. J. E. Hale et al's Lizzie Henderson 1, R. Bennington sur, lcn. A. T. Freet et al's G. C. Bonham 1, Robt. Potter sur, dk. Seymore Oil Co.'s Lucas 1, A. Castleberry sur, dk.

PANOLA COUNTY—Danciger O&R Co.'s Tatum 1, A. Bissell sur, rur. R. B. Dearing et al's Wooten Est. 1, Winny Mann sur, dk. Magnolia Pet. Co.'s E. A. Hull 2, Thos. Appelwhite sur, dr 1762 ft. Motex Oil Co.'s J. M. Furrh 1, Thos. M. Alstone sur, massive anhydrite 4660-4906 ft, dr 5990 ft. Logansport P. L. Co.'s Mannan Smith sur, sd 2742 ft shale.

SHELBY COUNTY—Wm. Redditt et al's Pickering Lbr. Co. 1, Stephen English sur, arr deepen 2165 ft. H. A. Stebbinger et al's Pickering Lbr. Co. 2, A. Hanson sur, elev 205 ft, 7-in csg 4962 ft, dr plug, fsg, td 5059 ft.

SOUTH TEXAS

SAN ANTONIO DISTRICT

ATASCOSA COUNTY—Frontier Oil Co.'s Oppenheimer 1, Sharp sur No. 518, pb from 2770 ft to 2667 ft to acidize, wtr broke in, sd. R. J. Roberts' J. M. Elder 1, D. Brister sur, dr in Mt. Selman section 3025 ft.

BASTROP COUNTY—J. L. Collins Co.'s W. T. Turner 1, A. Litton sur, dr 500 ft.

BEXAR COUNTY—Algra Oil Co.'s Edward G. Peters 1, Miguel Gotari sur, will re-dr this week, depth corrected by electric formation tester, 645 ft. American Gas Co.'s Oliver 5, Rodriguez sur, Gas Ridge, sd 3425 ft. W. D. Bacon et al's Seffel 1, Arocha sur, dr 1460 ft. Albert Chmel's Theresa McIntosh 1, J. W. Garrity sur, coring 805 ft. J. H. Devine et al's Miholski 1-A, Bustillo sur No. 29, pulled csg and abnd at 521 ft. C. E. Euton's Louis F. Ridder 1, Jose M. Baerrera Sur No. 58, lcn. P. N. McCullough's Bitter 1, J. M. Baerrera sur, still sd 550 ft. J. O. Williams' Hoch Est. 1, J. M. Baerrera sur, prep re-dr 483 ft. Woodward & Hardie's Devilbiss 1, Devilbiss sur, bailing 2284 ft; Herman Sons 1, Henry Pace sur No. 37, sd 1750 ft.

BLANCO COUNTY—E. L. Nixon's H. Hohenberger 2, A. Jonas sur No. 723, lime at 837 ft carrying water, will lower 6 inch csg to btm.

BURLESON COUNTY—Red Bank Oil Co.'s Gramm 2, E. Santef sur, could not lower 7 inch csg below 773 ft set at that depth, td 2430 ft.

CALDWELL COUNTY—J. R. Brinkley, Jr. Oil Co.'s (was G. A. McDonald) Mrs. A. C. Bridges 1, S. Seal sur, bailing some oil 2246 ft. W. F. Trammel, H. Hunter sur, pumping water and show of oil, water reported to be wash water, after acidizing with 5000 gals, td 2314 ft, top Buda 302 ft. H. F. Sackett and M. J. Keoughan's J. E. Cardwell 1, P. B. Bell sur, wet 10 inch csg at 40 ft, dr ahead.

DIMMITT COUNTY—Porter & Connor's Tideman 1, sec 10, I&GN Ry. sur, blk 10, 7000 ft test to start April 15. Wilcox O&G Co.'s Light Ranch 1, sec 67, I&GN Ry sur, woc 330 ft.

EDWARDS COUNTY—McNeil Pet. Co.'s Dybala 1, A. Thompson League, dr 3900 ft.

FRIO COUNTY — Amerada Pet. Corp.'s Halff & Oppenheimer 8, S. A. Ditch sur No. 1104, Pearsall, dr 7890 ft, top Glenrose 6992 ft; D. D. Harrigan 1, S. Flores sur No. 306, dr 4540 ft.

GONZALES COUNTY—Canow Creek Oil Co.'s W. L. Blotz 1, W. A. Mathews sur, wor. Tull et al's J. F. Bozka 1, McClure sur, sd 2625 ft.

GUADALUPE COUNTY—Blackmer et al's Cora & J. E. Mackey 1, James Hodges sur, Manford, lcn. R. B. Byrd's L. Schueneman 1, G. Dewitt sur No. 11, dr 2040 ft. J. E. Clark's T. C. Anderson 1, Robt. Hall sur, dr sh 1265 ft. Diamond Half Oil Co.'s E. Bibbs et al 1, J. W. Robinson sur, dr Glenrose lime 3777 ft, top Glenrose lime 3618 ft; Nich Marosis' Marierhofer 1, L. A. Peters sur, td 2175 ft, pb 780 ft, sd 2175 ft. Kennedy & Crowley's (Walter Myrrick et al) Jahns 1, J. K. Davis sur, td 2507 ft, in chalk, broken materials with streaks like serp, show oil last 28 ft, wo csg. Riddle Oil Co.'s Ned Herff 1, E. Gotari sur, td 2185 ft, top chalk 1892 ft, base 1988 ft, top Edwards between 2181-2184 ft, 7 inch casing 2180 ft, dr plugs, swab, no show, pb and perf in Austin chalk. S. Robertson et al's Blumberg 1, M. Baker sur, sd 853 ft. W. Scott Townsend's Tom Terrill 1, J. Cantu

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sur, still sd 300 ft. W. J. Walton et al's P. K. Delany 1, J. Cantu sur, top chalk 2020 ft, 7 in csg set at 2020 ft, dr plugs; Martin Hoffman 1, Dewitt sur, No. 11, td 2663 ft, pb to 2535 ft, prep to make potential test.

KENDALL COUNTY—Claud Smith's J. M. Gerfers 1, Mark Hodgson sur, sd 500 ft.

KERR COUNTY—S. W. Forrester's J. W. Bailey 1, Starky sur, No. 408, ur 945 ft, sh landed 8 inches on btm, lost bit in cavey hole, will dr past bit.

LEE COUNTY—J. W. Pederson's C. A. Turner 1, D. Hudson sur, td 6560 ft, sdtr and dr 6061 ft, swabbed little oil, 5 3/16 inch csg 6010 ft, Midway 2990 ft, Navarro 3350 ft, Austin chalk 4910 ft, Georgetown 5120 ft.

MEDINA COUNTY—Gates Hull Mead's Kreisle 1, sec 908, still sd 60 ft. Lynd & Fondren's Lynd 1, A. Smeller sur, sd 1400 ft. C. J. Webster O&G Co.'s Wm. H. Weimers 1, J. Haley sur No. 32, wo wtr. William & Gulley's Noonan Ranch 1, Brinkoff sur No. 318, hole caved 350 ft, woo, sd.

MILAM COUNTY—J. C. Kilgore, Trustee's W. H. Blancett 3, J. J. Acosta sur, abnd 50 ft. W. R. Ritchey's C. McDermett 1, J. R. Cockrill sur, sd 2520 ft, chalk 2960 ft, dr 3300 ft.

REAL COUNTY—Sun Oil Co.'s Dietert & Oppenheimer 1, sec 7, GWT&P Ry. sur, dr 5625 ft.

ZAVALLA COUNTY—H. F. Wilcox's T. J. Gillam 1, sec 11, GWT&T Ry. sur, dr 2555 ft.

CORPUS CHRISTI DISTRICT

ARANSAS COUNTY—Barnsdall Oil Co.'s Kate Edwards 1-A, W. Lewis sur, Lamar prospect, dr 6315 ft, ran electric formation tester at 5940 ft. Collins & Wilderson's McCampbell 1, blk 10, McCampbell sur, td 6558 ft, sand 6546-50 ft, perf 6550-58 ft, tested sw.

BEE COUNTY—Dirks Bros.' T. Stauch 2, 330 ft wl, 150 ft sl of 133-ac farm in sec 19, J. M. Uranga gr, dr 2950 ft. Lonnie Glasscock's J. B. Albinger 1, John Ryan sur, Beeville prospect, dr 1500 ft. H. H. Weinert et al's James Smith 1, J. R. Johnson sur, top Pettus sand 3003 ft, oil sand 3003-08 ft, prep run csg at 3008 ft.

BROOKS COUNTY—Standard Oil Co. of Texas' Mestina (Lease 2) 1, tr 11, R. G. Salinas sur, 6 mi n Alta Mesa pool, set 20 inch at 100 ft, dr ahead 107 ft. Texas Gulf Prod. Co.'s T. S. Proctor 1, blk 2, sec 20, Los Olmos & Blanco sur, ran electric formation tester 6028 ft and abnd.

CALHOUN COUNTY — Hiawatha O&G Co.'s John Roemer Est. 1, J. J. Ogsberry sur, started washing to btm, td 8378 ft.

CAMERON COUNTY—Stapper Pet. Corp.'s Port Isabell 1, blk 17, Port Isabell sub, Espiritu Santo gr, dr sh 5990 ft.

GOLIAD COUNTY—Dirks Bros.' Dr. Allen 1, Obid Marshall sur, se Slick field, dr 3875 ft.

HIDALGO COUNTY—Gulf States Oil Co.'s J. Engelman 3, lot 3, blk 70 Mestina gr, perf 6690 ft, 95 ft sand, testing, trying to complete in 6722-41 ft sand. Sterling O&R Co.'s J. C. Engelman 1, lot 5, blk 95, Mestinas gr, coring 7892 ft. Dayle L. Smith Oil Co.'s Fairbanks and Young 1, blk 44, por 46, sd 2350 ft.

JACKSON COUNTY—Cockburn Oil and T. Hargrove's Santa Theresa Farms 1, tr 34, sec 23, I&GN sur, mim. Shell Pet. Co.'s T. N. Mauritz 1-B, O. S. York sur, ab 306, sh and sand 5645-52 ft, odor. The Texas Co.'s T. N. Mauritz 1, Morris & Cummings sur, sec 4, ab 305, dst 5098 ft.

JIM WELLS COUNTY—Baltic Dr Co's B. W. Owens 1-A, Poitevent sur, woo 6018 ft. Tom Graham's J. Luby Est. 2, sh 4, Los Presnos de Abajos gr, td 5792 ft, perf 5423-33 ft in sand prep to run screen, electric formation tester to 5790 ft, 5½ inch csg 5471 ft, perf 5423-30 ft, w/12 shots, ran tubing, small amount of oil by artificial flowing device. Henshaw Bros.' W. H. McGriffin sec 230, mim. Tsesmelis & Reese's Martha Earhart 1, J. Suggs sur, ab 447, coring 2050 ft.

KARNES COUNTY — Victoria Dr. Co.'s John Yanta 1, S. G. Hardaway sur, still sd 1575 ft.

LAVACA COUNTY—Willshire Union Oil Co.'s A. Pohl 1, M. Wooten sur, abnd 3135 ft.

LIVE OAK COUNTY—R. A. David et al's Border National Bank 1, Stephen Hays sur, D&A 932 ft. R. H. Feltner's Sanger Ranch 2, CC&SF Ry. sur No. 385, mim. L. W. Stieren's Lange 1, sec 13, Simmons sub, T. Adams sur, dr 1000 ft.

NUECES COUNTY—Camp Prod. Co.'s C. P. Wardner, tr 1, sec 12, Stratton sub, coring 5689 ft. E. M. Jones' Lucy Cooke 1, Quadrilla Irr. sur No. 139, sd for orders 7006 ft. Magnolia Pet. Co.'s Clara Driscoll Sevier 2, E. Russell sur, prep dst 5430-39 ft from 5437-39 ft, sand, w, oil and gas odor, could not get to btm because of rubber packing left in hole. Shell Pet. Co.'s State of Texas 1, 100.8-ac tr, Laguna Madre Bay, driving piling. Sloan-Harvey & Green River Oil Co.'s F. Cassens 1, sec 26, Agua Dulce Farm lots, dk. Southern Minerals Corp.'s Richard King 1, sec 32, King Farm lots, coring 5110 ft. Texon Royalty Co.'s Sevier 2-B, Chapman Lands, woc 6350 ft. United Prod. Co.'s W. H. Harvey 1, Garcia sur, sand 7382-88 ft, coring ahead at 7500 ft. Wellington Oil Co.'s Sevier 14, Wm. Gamble sur, 350 lbs. pressure set 5½ inch csg at 5433 ft, completing.

REFUGIO COUNTY—United Prod. Co.'s J. J. O'Brien 12, Refugio Town Tracts, ds stuck on btm 8240 ft.

SAN PATRICIO COUNTY—Eleanor Oil Co.'s J. F. Green Est. 1, T. T. Williamson sur, coring 6800 ft. Phillips Pet. Co.'s H. Schmidt 1, sec 81, Paul sub, coring ahead at 6040 ft, hauling csg to lcn, probably test at 5316-39 ft. Plymouth Oil Co.'s E. H. Welder 65-C, sec 50, Welder sub, rec drill pipe 6380 ft, junked and abnd.

VICTORIA COUNTY—Commonwealth Oil & Gas Co.'s (George H. Echols) W. H. Bennett 3, J. E. Galban sur, 1 mi n of Heyser field, cored 3 sands 5415-72 ft, sh 5472-75 ft, oil sand 5462-72 ft. Magnolia Pet. Co.'s Wagner 1, T&NO Ry. sur No. 1, pb and set 7-in csg 2590 ft, woc perf 2517-19 ft, w/10 shots, dst 2517-19 ft, show 220 lbs pressure, 30 ft mud and oily test 10 minutes. Union Oil Co. of Calif.'s C. A. Keeran 3, M. de Leon sur, running csg at 6005 ft.

WILLACY COUNTY—Ruez-Morton, Inc.'s F. Armendiez 1, sh 4, San Juan de Carricitos gr, dk and sd; Johnson-Stillman 1, blk 23, sh 44, San Juan de Carricitos gr, sd 650 ft, laying water lines. Shell Pet. Corp., et al's Yturria 1, San Juan de Carricitos gr, sh 64, Viejo coring 8420 ft.

LAREDO DISTRICT

DUVAL COUNTY—Argo Oil Corp.'s Rodriguez 1, 330 ft nel, 1894 ft sel, of s¼ sur 498, top Jackson 1911 ft, abnd at 3035 ft. Atlantic Ref. Co.'s W. A. Lowe 1, sec 466, top Cole sand 2168 ft, show sw, coring 2771 ft. A. J. Brinkoeter's P. Garza de Rodriguez 1, sur 212, 1 mi w prod in Seven Sisters field, dr 2420 ft. Clark & Cowden's J. M. Richardson 3, sec 5, ru. Diamond Half Oil Co.'s J. F. Sanclair 1, sec 405, Elizabeth Gravis sur, bldg road. Frank Gravis' F. Vaello Puig 1, San Andres gr, dr 4500 ft. C. K. Gravis, Jr.'s C. Holzapfel 1, J. Poitevent sur No. 42, abnd 2539 ft. H. F. Grimm's Elizabeth Mew 1, 660 ft sl, 330 ft wl of sur 289, sp & set sur csg. Magnolia Pet. Co.'s Servando Benavides 23, O'Hern and Seacord Sub, El Mesquite gr, coring 1621 ft. Penn-Palangana Oil Co. et al's C. K. Gravis 1, 330 ft se of e cor sec 250 and in sec 254, ru. The Texas Co.'s Duval County Ranch 2-C, 1650 ft nel & 2350 ft nl sur 194, lcn. E. R. Thomas Est. et al's Atlee Parr 1, E. H. Valentine sur No. 26, dr 1810 ft. Geo. V. Viteri et al's Emilio E. Cadena 1, 660 ft s and e lines of lot 6, Cadena Ranch Sub, in J. M. Hinojosa gr, mi.

JIM HOGG COUNTY—J. V. Adams et al's W. P. Allen 1, sec 84, B. S. & F. sur, abnd 1419 ft. Cole Pet. Co.'s Yeager Ranch 1, sec 452, dr water well. Gifford Oil Co. and Locke Purnell's E. L. Armstrong 1, sec 43, junked and abnd, 4358 ft. Gifford Oil Co. and Locke Purnell's E. L. Armstrong 2, 330 ft nl, 990 ft el s½ sur 42, skidding on rig.

McMULLEN COUNTY—H. K. Boysen's J. E. Murphy 1, 6195 ft sl, 1235 ft el of J. E. Murphy sur No. 480, set sur csg and woc. Howell Oil Co.'s J. H. Martin Hrs. 1, near Nueces r, prep to re-dr. Humble's R. B. Swiger (Henry Gouger) 1, sec 46, dr 130 ft. Edwin M. Jones' Harry Ezzell 3, Thomas Adams sur, lcn. to start in 3 weeks. Reynolds & Richardson et al's Shiner Ranch 2, 330 ft nl and el of sec 39, Shumway sub, Shiner ranch, set sur csg, woc. Snider et al's B. G. Clauch 1, M. Hely sur, Gov't Wells sand 1052-58 ft, still shut down.

STARR COUNTY—John R. Clopton et al's Green 1, blk 5, sh 35, por 81, sand 3818-22 ft, tested gas, sprayed gasoline, went to sw, total

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705 ROSS AVE. DALLAS, TEXAS

depth 4620, sd; Tigerina 4, blk 12, sh 14-C, por 89, dr 1428 ft. Cook, Maris, Arnold's Starr County Cattle Co. 2, Cook, Maris, Arnold sur, por 89, ru, laying water lines. Danray Oil Co.'s (McLeod et al) C. Ramos 1, sec 150, dr 1200 ft. G. E. Dodd's Wood Est. 1, por 84, sand 1800-1820 ft, comp 35 bbls per hour 5/16 ch, cp 200 lbs. Glenn Harroun's V. C. Guerra et al's 1, Tr. B. Frank R. Campbell Sub, 10-in sur csg 188, dr ahead 830 ft. K. E. Merren's Starr County Cattle Co. 1, blk 34, por 89, fighting to keep well under control and prevent blowout from gas sand at 5377-81½ ft, 3000 sacks of commercial mud placed in the hole over the week-end and still 400 lbs pressure on csg head; it is stdg full of mud; sand in Cockfield. Moss & Heard's S. B. Ricaby 3, por 38, testing sw 1315-20 ft sand, shows oil sand 1604-11 ft, making 30 to 35 bpd of crude 3/16 in ch, tp 236 lbs, cp 245 lbs. F. P. Schwab & Fred Foster's Munoz 1, Javali gr, lcn.

WEBB COUNTY—Mills Bennett Prod. Co.'s M. D. Slator 2, 330 ft nel and nwl blk 39, Mission Oil Co. Subd, J. V. Barrigo gr, lcn. W. C. Billings' Fee 1, 330 ft nl, 990 ft el sur 2, dk, 150 ft 10-in csg 20 ft. Bolling & Coffey's A. Villareal 1, blk 17, sec 768, pits, wor. Eugene Turner, Jr.'s R. Saldivar 1, 2760 ft nl, 700 ft el sur 657, sp. Kepley Prod. Co.'s W. C. Billings 1, sec 5, lcn. O. W. Killam's Fee 1, sec 1690, abnd 5245 ft; Laurel Bros. 1, sur 330, 3 mi ne Oilton, sp. Lu-Tex Oil Co.'s Lone Star Con. Co. et al 1-A, por 12, 13 & 14, dr 1800 ft. Joe Palmer et al's Laredo Nat'l Bank, sec 463, abnd.

ZAPATA COUNTY—Mills Bennett's F. B. Martinez 1, sh 1, blk 84, dr 1897 ft, swabbed dry on production test of snd 2190-2225. Fidelity O&R Co.'s (Dan Auld) Gopher 1, blk 9, sec 5, sh 8, Borrego gr, sand 700-715, little odor, ran electric formation tester and abnd. H. B. Lewis' S. Benavides 1, blk 39, Fansler & O'Hern partition, Villa gr, dr 540 ft. Magnolia's Gonzalez-Cuellar 1, Cerrito Blanco gr, 1 mi w Cuellar field, 7-in csg 1100 ft, sand 1100-1116 ft, 260 lbs gas 4½ min, ⅔-in ch, woc. Magnolia Pet. Co.'s Ramona Cuellar 5, 320 ft sel &swl of s¼ sur 245, ru. Randolph Wheeliss' Mrs. S. Welsh 1, 150 ft nwl & swl blk 1, e½ Baleman sur, dr 1335 ft, sand 1212-1241 ft, slight odor 30 ft mud & fresh water. The Zapata Corp.'s Justina Garcia et al 1, sh 3, Comitas gr, and 1126-33 ft tested dry 1133 ft, sd, woo.

TEXAS GULF COAST

BRAZORIA COUNTY—Pure's L. M. Slade 1, Peach Point prospect, S. F. Austin sur, abst. 20, dr shale 6234 ft.

CHAMBERS COUNTY—Sun's White 1-A, Seabreeze area, T&NO sur, sec 128, comp 6 bbls distillate daily 8346 ft; same operator's White 1-B, Seabreeze area, Wm. Mays sur, mixing mud 9637 ft.

FT. BEND COUNTY—Research, Inc.'s J. M. Moore 1, ne of Orchard, S. Kennedy sur, spudded water well.

HARRIS COUNTY—H. M. Harrell & O. L. Brace's Bullock 1, ne of Ogburn, C. Bowman sur, dr shale and lime 3568 ft. Hamil & Smith's Zappe 1, Bammel area, J. Farwell sur, testing 6211 ft. Stanolind's Oates 1, Clinton field, C. Martinez sur, circulating 8501 ft; same operator's Warren Minerals 1, Hockley dome, H. & T. B. sur No. 1, testing 3808 ft. Texas Gulf Producing Co.'s Gillespie 1, Aldine prospect, S. Contreras sur, perforating 7100 ft.

JEFFERSON COUNTY — David B. MacDaniel's Nona Mill 1, Gilbert Ranch prospect, J. G. Grant sur, dr shale 5728 ft. Magnolia's Phelan 1, sw of Amelia, Cheek area, S. Stivers sur, dr shale 1539 ft. Humble's Jefferson Land Co. 1, Cheek prospect, C. Hillibrand sur, cutting and pulling 7845 ft.

MATAGORDA COUNTY — Continental's Robbins 2, Citrus Grove prospect, C. Franz sur, woc 8912 ft. Glenn H. McCarthy's J. Croker 1, Foley 1, Palacios prospect, L. Goodwin sur, testing 7895 ft. Sun's Craig 2, Hawkinsville dome, J. Williams sur, dr shale 4629 ft. United North & South Development Co., Stodard 1, sw of Buckeye, Cotton sur, dr shale 8925 ft.

POLK COUNTY—Mayo et al's C. Mayes 1, w of Segno, J. G. Loving sur, washing to bottom, 1500 ft.

TYLER COUNTY—Republic's Hurd 2, near Spurger field, N. Hurd sur, sd for fuel 6220 ft.

WALLER COUNTY—N. Blumenthal's A. Kelly 1, ne of Hempstead, S. Hardin sur, dr shale 1185 ft.

WASHINGTON COUNTY—Sun's Lauter 1, Clay Creek area, N. Clay sur, sd 7368 ft.

WHARTON COUNTY—J. E. Hutchins' J. J. Wensley 1, near Shell's Seydler 1, J. Tumlinson sur, dr shale and lime 4525 ft. Texas Co.'s Kluck 1, Blue Basin prospect, J. Hyland sur, sdtr 4381 ft; same operator's Weatherer 1, e of Louise field, Ogden sur, abn 6524 ft.

UTAH

GRAND COUNTY—Columbia Crude Corporation's Roth-Government 1, ne sw 12-25s-20e, cemented 7 in csg at 2132 ft, td at 2138 ft in oil sand. Utah Southern Oil Co.'s Hyde-Government 1, s nw nw 32-22s-20e, dr 6571 ft in Hermosa lime.

WYOMING

ALBANY COUNTY—Hal Blakeman's Chappell 1, cne nw 32-21n-76w, dr 1690 ft.

CAMPBELL COUNTY—G. J. Sherin et al's Rohdes 1, ne se sw 24-49n-74w, dr 400 ft.

CONVERSE COUNTY—Chadron-Osage Oil Co.'s State 1, sw sw sw 16-32n-69w, dr 3038 ft. Wyoming Southern Oil Co.'s Jennie Evert 1, nwc n sw 26-32n-69w, mim. Company's Salisbury 2, nec nw se 27-32n-69w, dr 250 ft.

NIOBRARA COUNTY — Riggs Drilling Co.'s A. A. Spaugh 2, se sw sw 32-34n-65w, dr 1348 ft.

PARK COUNTY—General Petroleum Corporation's Government 1, nw nw nw 33-37n-100w, coring at 5780 ft with 9⅝ in csg set at 5668 ft.

UINTA COUNTY—Beacon Dome Oil Co.'s Union Pacific 1, cse 29-14n-118w, location. E. A. Ottman et al's Government 1, se nw 26-14n-119w, mit, cable.

Hoists

The Harnischfeger Corporation, 4400 West National Avenue, Milwaukee, Wisconsin, has issued Bulletin No. H-5, called "P&H Hoists." Profusely illustrated with more than 25 industrial application photographs, the bulletin describes the added advantage in handling "off-the-floor."

Drill Collars

The National Supply Company, Toledo, Ohio, recently issued Bulletin No. 136, describing its forged steel rotary drill collars. The bulletin is available for free distribution.

Welding Machine

The Lincoln Electric Company, Cleveland, Ohio, has available for free distribution bulletin No. 320, describing its "Dual Continuous Control Shield-Arc" welding machine.

Now Available

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KENT

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Eleventh Revised Edition

ROBERT T. KENT,
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and a staff of specialists.

This volume deals with the entire field of power and its applications that are of interest to the mechanical engineer, while present-day methods in design and shop practice will be covered in detail in the forthcoming second volume of the handbook, to be ready in 1937. Basic mathematics, physics and chemistry have been removed to a separate volume.

Contents of the POWER Volume: Air; Water; Heat; Combustion and Fuels; Steam; The Steam Boiler; The Steam Engine; The Steam Turbine; Condensing and Cooling Equipment; Refrigeration and Ice Making; Heating, Ventilating and Air Conditioning; Internal Combustion Engines; Gas Producers; Transportation; Electric Power; Power Test Codes; and Mathematical Tables.

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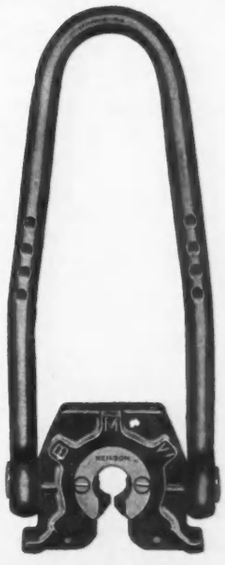
Bodies of molybdenum steel with forged bails. Easily operated. Safe. Spring and plates quickly replaceable. Interchangeable plates. Two latches. Each latch, alone, will hold the rod. Two sizes —for light and heavy duty.



Principal B-M-W Products are obtainable at supply stores, including: ● ADMORE Insert Pump Anchors; ● NEILSON Tools (Safety Sucker Rod Hooks, Tubing Hooks, Rod Elevators, Sucker Rod Sockets, etc.); ● BALLS and SEATS (made for every pumping service); ● ADMORE Liner Barrels; ● TEX TYPE Plunger Fittings and Valves; and ● COLLINS Belt Clamps.

BRADFORD MOTOR WORKS INC

OIL WELL SUPPLIES

BRADFORD, PA. — TULSA, OKLA.

NEW PRODUCTS FOR THE FIELD
Machinery • Tools • Catalogs • Books

SEISMOGRAPH DRILL
Sullivan Machinery Company

Sullivan Machinery Company, Chicago, recently introduced its Number 37 seismograph drill, with which the model IXB Hercules gasoline power unit is furnished as standard equipment. Through a 3-speed transmission it supplies the power for the rotary

Sullivan Seismograph Drill, Powered by Hercules Gasoline Engine.

drill and is carried with the pumps, drum, folding mast and other machinery on a short-wheel-base platform truck.

The mobility and compactness of the entire unit make it useful in geophysical exploration by the seismograph method in isolated areas which are not easily accessible by well-traveled roads.

EXCAVATOR
Buckeye Traction Ditcher Company

The Buckeye Traction Ditcher Company, Findlay, Ohio, has placed on the market a line of ½, ⅝ and ¾ yard excavators, with shovel, crane, dragline, clamshell and trench hoe attachments. The new machines are known as Buckeye Clipper, Models 50, 60 and 70. Characteristic of the modern engineering found throughout the machine is the use of a tubular dipper stick, combining strength and flexibility with moderate weight. The streamlined cab of the new Clipper reflects this modern engineering.

One of the new departures in design found exclusively in these excavators is the perfected system of control by metered vacuum. All operations are controlled from a simple control panel, where small levers move easily at the touch of the operator'sfingers. Almost effortless operation eliminates the natural lag that ordinarily cuts down efficiency when operators tire from handling the old types of heavy control lever machines, the manufacturer claims,

Developed and perfected for specific use on the new model, this metered vacuum control is the standard product of a responsible automotive equipment manufacturer with national service facilities. Among other advantages of this vacuum type of control system is its freedom from trouble due to extremes of temperature, small leaks, or water in the lines. Automatic vacuum controlled brakes add considerably to the efficiency of operation.

Other evidence of consideration for the comfort of the operator is found in the comfortable, air cushioned seat, convenient rack for tools, and handy compartments for personal articles.

WATER GAUGE ILLUMINATOR
Wright-Austin Company

Wright-Austin Company, Detroit, has announced a simple device for the quick reading of water gauges. It consists of a Neon light tube and a magnifying lens placed behind the water gauge, attached by two screw clamps which grip around the top and bottom water gauge fittings. The water or liquid filled part of the gauge glass stands out as a broad neon red band, the empty space above appearing as a hair line red stripe. The water level can be read distinctly, day or night.

Neon rays do something more than penetrate darkness. They penetrate mist, steam, dust and fog almost as readily. And they can be plainly seen even in day light. The manufacturers claim that this new illuminator gives clear visibility of the actual water level at a distance of 150 feet or more under any conditions.

Buckeye Clipper

DRILLING BIT
Dean Oil Tools Company

Dean Oil Tools Company, Compton, California, has introduced a new type roller bit, fully machine matched, part fitted into part, fabricated and welded into a solid unit, for use under exacting well drilling conditions at the great depths usual in well drilling today.

Dean Bit

The new bit is a balanced, four-cutter, cross pattern design. The cutters are horizontally opposed and equally spaced about the hole bore area. Outside and inside cutters are of proportional diameters and proportional tooth depth, insuring equal penetration across the hole bore to drill thereon a fishtail shaped design of drilling pattern. The high center of the pattern holds the bit in a straight drilling line, the outside of the bit frame having such ample clearance that it does not contact the sides of the hole bore under any condition; the roller cutters alone contacting the drilled surfaces at all times, it is claimed.

The roller cutters are made of forged 5 percent nickel steel, and carry extra long teeth and are fully heat treated and faced with tungsten carbide to give the best wear characteristics possible. Due to the large ball bearing races upon which the cutters of the bit are mounted, there is no jambing or dragging in cutters.

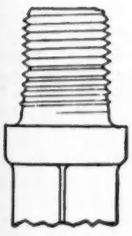
The outside or gauge cutters are of such design that one side is solid and carries an external protruding hub. Upon this hub a hardened thrust washer is mounted which fits into a recess in the bit body and absorbs all lateral thrust which the bit may take in making hole. The outside cutters contain a large ball race, which when matched with the race in the trunnion and filled with balls forms a self-locking roller bearing characteristic which absorbs any strains set up in any direction, the manufacturer claims.

The inside cone-shaped cutters are mounted on a combination ball and roller bearing. The rollers carry the vertical load, and the balls absorb the lateral thrust on these cutters.

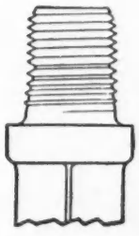
"Prayer Alone is Not Enough"!

Strength in sucker rods is not attained by prayer and fasting. It only comes as a result of years of study and experience on the part of the manufacturer and operator. Because of this experience reflecting decades of contact with the oil industry, Axelson is today offering three grades of sucker rods. The installation of whichever one of these rods is best suited to meet individual well pumping conditions is not guaranteed by Axelson to eliminate all pumping trouble. It is, however, the honest belief of Axelson engineers and Axelson field men that these rods will REDUCE BREAKAGE, INCREASE ROD LIFE and DECREASE PUMPING COSTS.

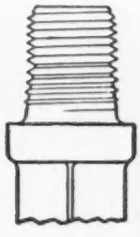
From any Axelson representative, you may obtain the full story of Axelson's manufacturing operations and field laboratory tests which make Axelson Rods today's best sucker rod buy.



Axelson No. 60 Sucker Rods are made from exceptionally high-grade carbon steel under strict alloy practice. They are fully tempered from end to end, assuring consistent physical properties. The ductility and impact resistant properties of these rods is such as to indicate their practical use for all average to heavy pumping conditions.



Axelson No. 59 Sucker Rods are made of special alloyed steel that materially aids their resistance to corrosion and are fully normalized and tempered from end to end. They present excellent physical properties combining increased ductility and impact resistance with high yield and tensile strengths. These rods are desirable for pumping wells where extra heavy loads are encountered and where irregularities in pumping movements are unavoidable.



Axelson No. 69 Sucker Rods are made from a high alloy special nickel molybdenum steel produced in electric furnaces. These rods are especially resistant to corrosion, are fully normalized and tempered from end to end. They offer excellent yield and tensile strengths with great ductility and impact resistant properties.

Axelson Manufacturing Company, P. O. Box 710, Vernon Station, Los Angeles • St. Louis • 50 Church Street, New York • Tulsa
Mid-Continent and Eastern Distributor: **Frick-Reid Supply Corp.** • *Rocky Mountain Distributor:* **Great Northern Tool & Supply Co.**

DEEP WELL PLUNGER PUMPS **AXELSON** **SUCKER RODS**

This Week with the Industry's EQUIPMENT SUPPLIERS

Butler Manufacturing Company Increases Sales Personnel

Increased oil equipment and steel building sales of the Butler Manufacturing Company, in Kansas City, Missouri, and Minneapolis, Minnesota, have necessitated additional sales executive manpower. March 1, G. A. Burns moved his headquarters from Minneapolis to Kansas City, to serve in an advisory capacity as manager of the oil equipment and steel building departments for both the Kansas City and Minneapolis divisions. Before his promotion, Mr. Burns was sales manager of the oil equipment division at Minneapolis.

Carl W. Jackson, oil equipment city salesman for Minneapolis, will assume Mr. Burns' duties as sales manager of the northern division in oil equipment.

Louis Brown will continue in his capacity as sales manager of the oil equipment division of Kansas City.

John F. Hunter retains his position as sales manager of steel buildings for Minneapolis.

The Continental Supply Company Holds Sales Conference at Dallas

With more than one hundred company men and factory representatives present, The Continental Supply Company held its annual sales conference in Dallas, March 22 and 23, for the purpose of discussing plans for the year.

District managers, assistant district managers and officials in the Dallas office made up the company's representation, while engineers and officials of factories represented by The Continental Supply Company were present to discuss equipment and manufacturing trends.

Presided over by W. J. Morris, president, the business session featured the discussion of the company's progress during the past year, together with plans for this year. At a banquet held on the first night of the conference nearly 200 Continental employees and factory representatives were present, with Frank I. Brinegar, vice president, acting as toastmaster.

Frank Purnell, president of Youngstown Sheet and Tube Company, delivered the principal address of the conference.

Union Wire Rope Corporation Elects Officers and Directors

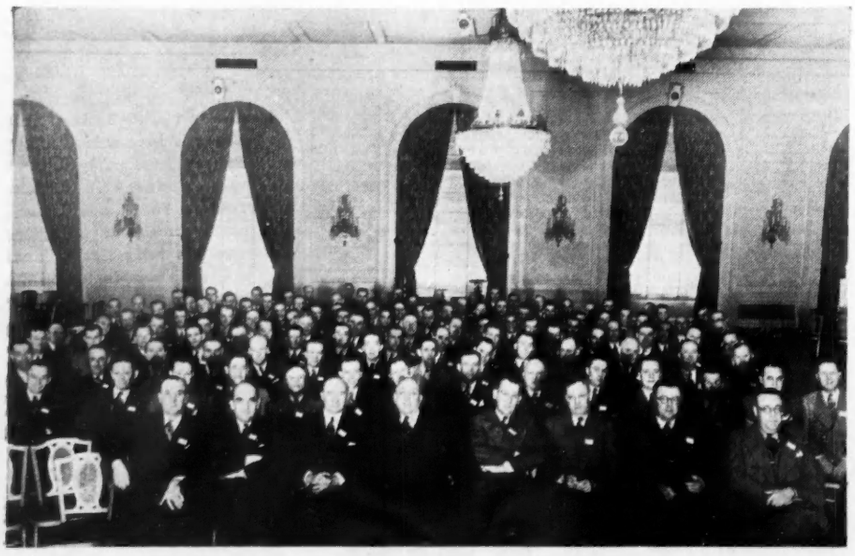
The annual meeting of the stockholders and directors of Union Wire Rope Corporation was held at the company's Tulsa offices, March 23. A. F. Beringer, president of P. W. Brooks & Company, Inc., of New York, was elected to the board of directors, succeeding Frank L. Moore, who recently resigned.

Directors reelected were: R. H. Bartlett, M. G. Ensinger, H. R. Gruber, H. O. McClure, Phil D. Morelock and E. A. Peedy.

Officers of the corporation elected for the coming year are: R. H. Bartlett, chairman of the board; M. G. Ensinger, president and general manager; H. R. Gruber, vice president and sales manager; J. H. Hatch, vice president and treasurer; J. C. Soll, secretary and assistant treasurer; H. M. Lawrence, assistant secretary and assistant treasurer; W. Voigtlander, chief engineer, assistant secretary and assistant treasurer.

Worthington to Go Abroad For International Business

George M. Worthington, New York, recently appointed manager of the oil department of International Business Machines Corporation, St. Louis, will sail soon on an extended trip to survey the world's oil industry, with the object of increasing sales of electric bookkeeping and accounting machines.



The Continental Supply Company's salesmen met with representatives of their factories last week, and found time during a busy conference to pose for this picture.

Harry R. Ansel Forms The Kor-Lok Company

Harry R. Ansel, registered mechanical and structural engineer, has formed The Kor-Lok Company, of which he is president, located in the Union Trust Building, Cleveland, Ohio. This company is introducing to the sheet metal market an interlocking corrugated sheet for roofing and siding that reduces capillary attraction and eliminates nail holes. The material has many applications in the petroleum industry.

HARRY R. ANSEL
His new company offers steel sheets without nails.

Link-Belt Elects Directors At Chicago Annual Meeting

At the annual meeting of stockholders of Link-Belt Company held in Chicago recently four directors were elected to serve until 1941. Bernard E. Sunny, Chicago, and James S. Watson, Indianapolis, succeed Arthur L. Livermore, deceased, and Austin L. Adams, resigned. The re-elected directors are Staunton B. Peck, Chestnut Hill, Pennsylvania, and Harris Whittemore, Jr., Naugatuck, Connecticut.

Sunny is a director of a great many companies, among which are the General Electric Company, Illinois Bell Telephone Company, Public Service Company of Northern Illinois, Wilson & Company, Chicago Surface Lines, and the First National Bank, Chicago.

Watson is vice president in charge of the Indianapolis plant operations of Link-Belt Company, having served the company continuously for 44 years.

Powers Given Post With Lincoln Welding Foundation

The James F. Lincoln Arc Welding Foundation, sponsor of the $200,000 arc welding prize contest, announces the appointment, as assistant secretary, of Edmond C. Powers who has been engaged for three years in technical writing for The Lincoln Electric Company, Cleveland, Ohio.

now . . .
the "Sunshine Process"
(ADDITION OF VITAMIN D)
makes good
Bread and Milk
BETTER

now . . .
the Preforming Process
makes good Wire Rope *BETTER*

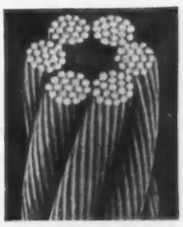
● The addition of Vitamin D concentrate gives food the life-giving value of sunshine. A basic improvement to an age-old product.

Preforming gives wire rope the life-giving value of relaxation. A basic improvement to a century-old product.

Preforming relaxes wire rope. It puts all component wires and strands in a state of ease. They are comfortable, unstrained, flexible. Preforming thereby tends to eliminate the destructive internal torsional stress, tends to reduce crankiness and kinkiness.

Preforming makes wire rope easier to handle, easier and faster to splice or socket. For many applications preformed wire rope lasts longer, gives better service.

Ask us to send you a sample. Learn all the facts about its true superiority. For many wire rope applications, preformed wire rope will give you much greater dollar value.



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for SAFETY · ECONOMY · EFFICIENCY

Squeaks from the Bull Wheel

Matter of Time

Two old women were having a heart-to-heart chat. One said to the other, "So you're troubled with constipation too, are you? What do you take?"

"Well," answered the other, "I just takes me knitting."

Threat

What do you mean by kicking my dog? He didn't even bite.

Yes, but he raised his leg, and I thought he was going to kick me.

Its Best Use

His play had been refused seven times, but he still kept turning up with it, rewritten here and there. The eighth time, the manager told him firmly that it was useless.

"But, sir," said the playwright, "is there no possible way you could put my farce on the stage?"

"Well," was the reply, "there's one way, but I don't know if you'd submit."

"Oh, I'd submit," he cried. "I'd submit to anything."

"Then," said the manager, "we'll grind it up and use it as a snowstorm."

Helpful

Dining in a restaurant with her husband the other day, a lady missed her gloves when she was on her way out. Murmuring something to her husband, she hurried back to the table to look for them. Not seeing them on the table she lifted the cloth and began to grub about on the floor. Just then a waiter came up. "Pardon me, madam," he said, "but the gentleman is over there by the door."

His Demand

A prominent politician, who had just taken part in an election where the voting was found to be illegal, was called up on the telephone one day and informed that he was the father of triplets.

Becoming greatly excited, he shouted into the receiver: "I demand a recount."

In Soak

Did you put my blue evening dress into soak, as I told you?

Yes, mum; but they'd only give me 50 cents on it.

To Match

Architect: "Now, if you'll give me a general idea of the kind of house you need . . ."

Client: " I want to have something to go with a door-knocker my wife brought home from Europe."

Modesty Profound

Joe Scribble of the Daily Item was interviewing Vilma Vacuum, movie-dom's most glamorous star. Vilma, noted for her silence, seldom granted an interview to the lowly press.

"Please do not keep me long," commanded Vilma rather severely. "I hate interviews. I wish newspapers would leave me alone."

"I'll only be a minute, Miss Vacuum," replied Joe. "I just want a message to your fans for our paper."

"You may tell them," pontificated Vilma, "that I despise publicity in any form."

"Marvelous," declared Joe. "In be-

CHARLEEN

Eighteen months old daughter of Mr. and Mrs. Charles W. Laas of Vinton, Louisiana, seems to be getting a big kick out of The OIL WEEKLY—probably the Squeaks page, while taking her morning sun bath.

half of our paper I want to thank you for the story. Goodby, Miss Vacuum."

"Oh, one thing more," added Vilma. "If you put that story in the back of the paper where nobody'll see it, I'll raise hell, see?"

Just Curious

The village fire engine was careening toward a small hamlet.

Suddenly a hefty housewife left a group of her cronies and, dashing into the middle of the road, waved her arms frantically in front of the oncoming engine. The driver pulled up with a jerk.

"Where's the fire?" he shouted.

"Well, that takes the cake," retorted the woman. "That's what we all want to know."

The Advertisement

At the village concert, Miss Brown was encored repeatedly for her recitation of "The Village Blacksmith." On coming behind the stage for the second time she was accosted by a burly, fair-haired man.

"I'm the man you've been talking about," he said. "Will you tell them when you go back that I've bicycles for hire, as well?"

Deep Stuff

"What did you do last summer?"

"I worked in Des Moines."

"Coal or iron?"

In Style

My wife thinks of nothing but motoring and golf. I'm getting tired of it.

Well, at least she's in the fashion.

Yes, but she's such a failure at it. In golf she hits nothing, and in motoring she hits everything.

Gotkool
WATER CANS
& COOLERS
GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. GOTT Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today! . . . . . .
Gott
GOTT WATER CAN
Made in 1½, 3, 5, and 10 gallon sizes.
GOTT WATER COOLER
Made in 3, 5, 8, 10, and 20 gallon sizes.
H. P. GOTT MFG. CO.
WINFIELD, KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY